

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT TRIAL AND APPEAL BOARD

HEBEI HUATONG WIRES AND CABLES GROUP CO, LTD.
Petitioner

v.

GULF COAST DOWNHOLE TECHNOLOGIES LLC
Patent Owner

CASE: IPR2023-00908
U.S. PATENT NO. 7,581,565

DECLARATION OF DR. JOHN BALLATO

I, John Ballato, pursuant to 28 U.S.C. §§ 1746, declare under penalty of perjury that the following is true and correct:

I. Background and Scope of Work

1. I am a Professor of Materials Science and Engineering at Clemson University. My office address is 91 Technology Drive, Anderson, South Carolina 29625.

2. I have been engaged by the law firm K&L Gates, counsel for Petitioner Hebei Huatong Wires and Cables Group Co, LMT (“Huatong”), to render opinions regarding the validity of U.S. Patent 7,581,565 (‘565). Those opinions are expressed herein. In forming those opinions, I have reviewed the documents referenced herein. I have also relied upon the knowledge of the cable art that I have accumulated over the course of my professional career, which is set forth in detail in the paragraphs below.

3. I received a B.S. degree in Ceramic Science and Engineering from Rutgers University in 1993. I then earned the Ph.D. in Ceramic and Materials Engineering from Rutgers University in 1997. While pursuing the Ph.D., I also taught classes on fiber optic technologies, including cable design, at the Somerset County Technical Institute, to the early generation of fiber optic cable installers.

4. After completing my doctorate, I was hired in 1997 as an Assistant Professor in the Department of Ceramic and Materials Engineering (now the

Department of Materials Science and Engineering) at Clemson University. In 2002, I was promoted to the rank of Associate Professor and granted tenure. In 2007, I was promoted to Professor. Since 2015 I have held the J. E. Sirrine Endowed Chair of Optical Fiber, the only such position in optical fiber in the United States.

5. I have published over 500 technical papers, am a named inventor on over 35 patents worldwide, given 230 plenary and invited lectures, served on 125 graduate committees, and have taught over 3,500 students in the classroom.

6. I have received many professional honors over the course of my career. For example, I am a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), the Optical Society of America (OSA), the International Society of Optical Engineering (SPIE), the American Physical Society (APS), the American Association for the Advancement of Science (AAAS), and the American Ceramic Society (ACerS), as well as an elected member of the U.S. National Academy of Inventors. These honors, along with numerous international awards, all relate to my efforts studying and teaching about optical fibers and materials.

7. My *curriculum vitae*, which is attached as Appendix A, more fully sets forth my professional credentials, as well as a list of my publications and the cases in which I have testified at a deposition, hearing, or trial.

II. Opinions

A. The ‘565 Patent

1. The Teachings of the ‘565 Patent

8. The ‘565 Patent issued on September 1, 2009 from U.S. Patent Appl. No. 12/178,246 (“the ‘246 Application”), which claimed priority of July 23, 2008. A Reexamination Certificate, modifying the claims of that patent, and cancelling the remainder, issued on June 9, 2015.

9. The purported invention of the ‘565 Patent is directed to “a tear cord used to conveniently and safely remove a protective jacket surrounding a solid wall metal tube.” Ex. 1001, col. 1, lines 41-43.

10. Reexamined claim 1 of the ‘565 Patent reads:

A jacketed metal tube comprising a metal tube, a first protective jacket adjoining and surrounding the metal tube, and a tear cord positioned between the metal tube and the first protective jacket characterized wherein the protective jacketed metal tube is for use in downhole applications relating to hydrocarbon extraction, wherein the protective jacketed metal tube has a wall which is of hollow cylindrical shape and is smooth walled, solid, substantially straight, continuous, without break or interruption, is structured to be hermetically sealed, maintain a positive or negative pressure, and is structured for connection to hermetically sealing compression fittings to convey fluids downhole, and in that the tear cord is positioned proximate to an outer surface

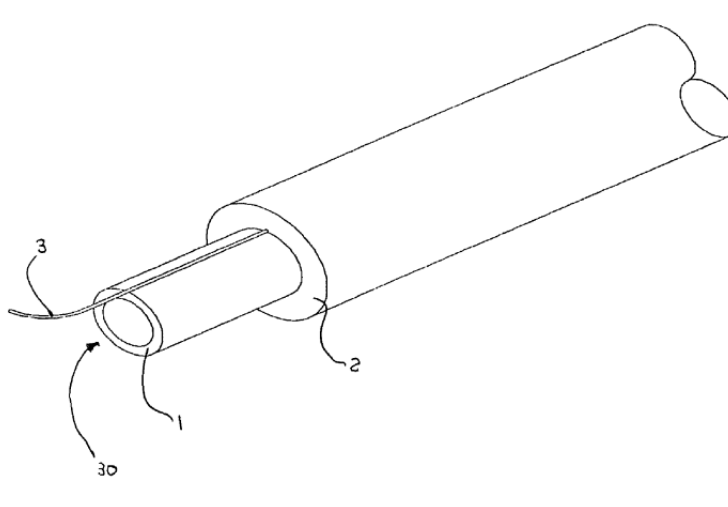
of the metal tube and inside the diameter of the outer first protective jacket and is able to be pulled back to create a slit in the first protective jacket and to allow the first protective jacket to be separated from the metal tube without damage to the metal tube surface.

Ex. 1002, col. 1, lines 24-43.

11. Jacketed tubing of the type described in the ‘565 Patent is used “in a hydrocarbon production downhole well bore.” Ex. 1001, Abstract. Such tubing “may also contain an electrical power, electronic data transmission or fiber optic lines.” *Id.*, col. 2, lines 19-20.

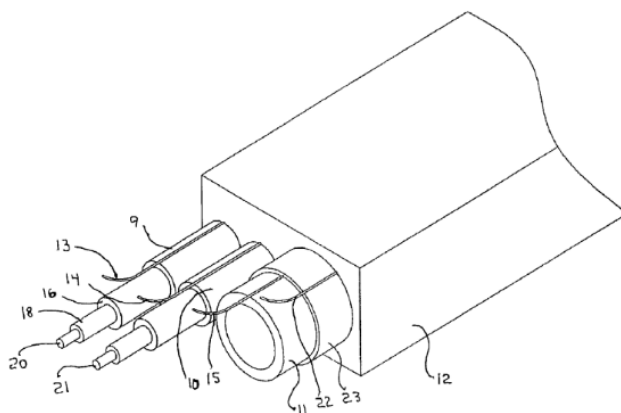
12. Irrespective of the application, the ‘565 Patent teaches that “[t]he sealing surface of the tubing is of prime importance, *i.e.*, the wall of the tubing is to be free from nicks and gouges.” *Id.*, col. 2, lines 21-22. Such “damage can result from use of a knife or other sharp edge instrument to cut away the protective jacket.” *Id.*, col. 2, lines 23-24. Gouges and nicks will result in pressure loss. *Id.*, col. 2, lines 42-44). To solve for this problem, the ‘565 Patent the use of “a tear cord placed between the tube and the protective jacket,” which allows the worker to pullback the tear cord and thereby create a slit in the jacket.” *Id.*, col. 3, lines 5-7.

13. The invention claimed in the '565 Patent, in its simplest form, is depicted in Figure 1 of that patent:



Ex. 1001 at 2.

14. In the above depiction, a tear cord 3 is placed adjacent to the tube 1 under the protective jacket 2. '565 Patent, col. 3, lines 22-23. A more complex, multi-tube iteration of the claimed invention is depicted in Figure 3 of the '565 Patent, which shows tubes 9-11, with tube 11 jacketed by elements 12 and 23, with two separate tear cords (15 and 22) for one of the tubes:



15. “[S]maller diameter” tubes 9 and 10 “provide mechanical support 16 and the innermost layer providing electrical insulation 18 for the wire or fiber optic cable 20, 21.” Ex. 1001, col. 4, lines 11-13. Although not specifically described as such, a person of ordinary skill in the art would understand that tube 11, with its larger diameter and hollow structure, is intended to convey “hydraulic fluid or chemicals” into a well bore, as described in the Abstract of the ‘565 Patent. In other words, a skilled person would understand that the multi-tube embodiments of the ‘565 Patent are intended to convey different media, *e.g.*, fluids, and electronic and optical information.

16. Representative claim 1 specifies that the claimed jacketed metal tube is to be “hermetically sealed,” and must “maintain a positive or negative pressure.” Ex. 1002, col. 1, lines 34-37. The specification teaches “the integrity of the tubing diameter and good uniform sealing surface is important in making a hermetically sealed connection.” Ex. 1001, col. 2, lines 53-56. It also teaches “[g]ouges and nicks may also penetrate the tube wall. For example, if the tube is conveying hydraulic fluid, there will be a pressure loss.” *Id.*, col. 2, lines 43-45.

17. While claim 1 is representative of the claims in the ‘565 Patent, method claim 18, and the two claims depending therefrom, further include the limitation “a first outer protective jacket around a metal tube to form a jacketed tube **which is spoolable**.” Ex. 1002, claim 18 (emphasis added). The ‘565 Patent does not describe

any embodiments of a “spoolable” tube. However, during reexamination, the Patent Owner contended that, “[a]lthough spoolable, the tubes are maintained substantially straight to prevent deformation from small radius bends” which is part of “the problem that is addressed” by the ‘565 Patent. See Ex. 1006 at 81.

b. Prosecution History of the ‘565 Patent

i. Original Examination

18. During original prosecution, the then-pending claims 18-20 of the ‘246 Application received a first office action rejection on section 102 grounds in light of U.S. Patent No. 5,574,816 to Yang et al. (“*Yang*”). Ex. 1005 at 41. Claims 1, 7, 14 and 15 received section 103(a) rejection in light of U.S. Patent Appl. No. 2003/178222 to Moore et al (“*Moore*”). *Id.* at 42. Claims 1, 4, 8, 11 and 13 separately received a section 103(a) rejection over *Yang* in view of *Moore*. *Id.* at 4. The then-pending dependent claims were objected to as being dependent on a rejected base claim, but would be allowable if re-written in independent form. *Id.*

19. An Examiner interview was held after the issuance of the first office action, wherein the applicant discussed an amendment to claims 18-20 specifying that the claimed tear cord is on the outer surface of the metal tube, as the tear cord was not intended to cut through the metal tube. Ex. 1005 at 26. This distinguished the claimed invention from *Yang*, which placed a tear cord underneath the metal

tube. *Id.* Claim 20 was amended to specify that the tear cord is located in a helical pattern along the longitudinal length of the cord. *Id.*

20. The Applicant also distinguished *Yang's* metal structure, which was not fluid-tight or solid. Ex. 1005 at 26-27. The *Yang* structure also did not provide a sealing surface. *Id.* at 28. *Moore*, which was combined with *Yang*, according to Applicant, did not indicate that its tube was smooth or had a solid wall. *Id.* at 27. Nor did *Moore* indicate that rip cord is placed over the metal tube. *Id.* at 28.

21. Separately, Applicant argued that dependent claim 8 calls for a second inner jacket outside the metal tube, and claim 11 requires positioning the tear cord selectively within the cable, neither of which were taught in the prior art. *Id.* The claims were amended accordingly. *Id.* at 22-25. In light of such amendments, the Examiner issued a notice of allowability. *Id.* at 14.

ii. Ex Parte Reexamination

22. On December 20, 2013, RSCC Wire & Cable, LLC filed a request for *ex parte* reexamination. Ex. 1006 at 369-412. The request claimed to raise substantial new questions of patentability in light of 10 prior art references. *Id.* at 376-77.

23. An office action was issued in response, finding that claims 1, 4, 5, 11, 13 and 24 were anticipated in light of 7,113,680 to Hurley et al. ("*Hurley*"). *Id.* at 211. Additionally, claims 1-5, 8, 10-17, 21 and 22 were rejected under section

103(a) in light of U.S. Patent No. 3,526,086 to Morgan (“*Morgan*”) in view of U.S. Patent No. 5,557,698 to Gareis et al. (“*Gareis*”). *Id.* at 212-13. Claims 6 and 9 were rejected under section 103(a) in light of *Morgan* in view of *Gareis* in further view of U.S. Patent No. 6,236,790 to Okada et al. *Id.* at 214. Finally, claims 1, 7, 18-20, 23 and 24 received a section 103(a) rejection in light of U.S. Patent No. 6,472,614 to Dupont et al. *Id.* at 215.

24. In response to this office action, the Patent Owner made clear that the field of endeavor of the ‘565 Patent “is the removal of protective jackets from hollow pressure tubes used in downhole operations while protecting the tube surface.” Ex. 1006 at 79.

25. The Patent Owner reiterated this characterization of the jacket removal problem solved by the ‘565 Patent:

Succinctly stated, [the ‘565 Patent] is for a downhole protective jacketed metal pressure tube wherein the jacket can be safely removed from the tube without damaging the tube surface. This allows the outer wall of the metal tube (sealing surface) to be used for creating an hermetic seal. Although spoolable, the tubes are maintained substantially straight to prevent deformation from small radius bends. ***That is the problem that is addressed by [the ‘565 Patent].***

Ex 1006 at 81 (emphasis added).

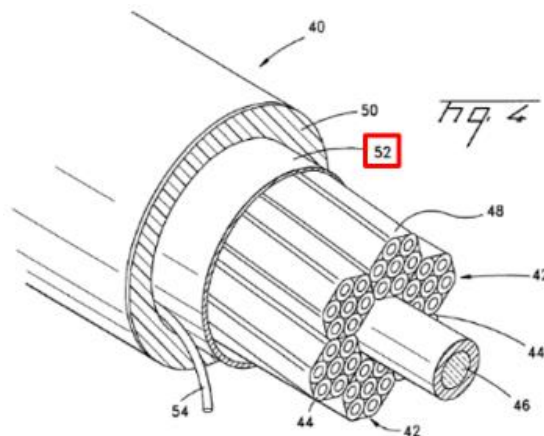
26. The Patent Owner submitted the declaration of Mark Watson supporting this statement, who declared that a “tear cord can be pulled back to create a slit in the jacket and allow the jacket to be separated from the metal tube without damage to the metal tube” (Ex. 1006 at 143, ¶ 7¹), which “protects the outer sealing surface of the high-pressure tubes” (*id.*) from the scratches and gouges that otherwise result from the use of cutting blades (*id.*, ¶ 4). In other words, the use of a tear cord allows a tube to maintain pressure.

27. In conjunction with this effort to distance the claimed invention from the prior art, the Patent Owner substantially amended the claims of the ‘565 Patent. See Ex. 1006 at 47-52. Those amendments fell into two general categories: 1) those directed to a purpose for the claimed apparatus, including, for example, “use in downhole applications relating to hydrocarbon extraction” (claim 1) and “to convey hydraulic fluid” (claim 2); and 2) those directed to characteristics of the claimed apparatus necessarily resulting from the separate structural limitations, *e.g.*, “structured to be hermetically sealed, maintain a positive or negative pressure,” and “structured for connection to hermetically sealing compression fittings to convey fluids downhole” (claim 1). Ex. 1006 at 47.

¹ There are two paragraphs labeled “7” in the Watson declaration. This citation is to the second such paragraph.

28. The Patent Owner then sought to distinguish the amended claims of the '565 Patent over *Hurley* on the ground that such reference “does not disclose a ‘smooth solid wall metal tube.’” Ex. 1006 at 59. The Patent Owner cited *Hurley*’s teaching of a “helically wound ‘ribbon like’ single piece of metal,” an “example” of which a “CPID interlock armor” having “an outer ridged surface.” *Id.* at 60-61. This structure, according to the Patent Owner, was not a tube that was “smooth, solid substantially straight, continuous, without break or interruption,” and therefore did not allow for hermetic sealing or the maintenance of pressure. *Id.*

29. The Patent Owner, in attempting to conflate the entirety of *Hurley*’s teachings into the single CPID interlock armor example depicted in Figure 8, thereof, effectively disregarded Figure 4 from *Hurley*, which clearly shows as element 52 a smooth solid wall metal tube:



Ex. 1004 at 7.

30. The '565 patent, as reexamined, has 20 claims, claims 1, 14 and 18 of which are independent. Claims 1-15, 22 and 25 are apparatus claims, while claims 18-20 are method claims. The purported invention of the '565 Patent is directed to "a tear cord used to conveniently and safely remove a protective jacket surrounding a solid wall metal tube." Ex. 1001, col. 1, lines 41-43.

31. *Hurley* teaches that, in Figure 4, "separation layer 52 can be formed from by [sic] an armor layer, for example, a metal that may be formed . . . from one or more pieces," and "may provide, for example, crush resistance." Ex.1004 at 10:46-52. In other words, *Hurley* taught the round, smooth sold wall, undeformed metal that, according to the Patent Owner during reexamination, was "structured for connection to hermetically sealing compression fittings." See Ex. 1006 at 62; Ex. 1003, ¶ 14. Notwithstanding these clear teachings regarding *Hurley's* Figure 4, the Patent Owner suggested to the Examiner that separation element 52 therein may be formed only of "polyester such as a MYLAR film." *Id.* at 58.

32. In any event, after the applicant amended the claims during reexamination, the Examiner conducted an interview where "accepted amended claims were discussed." *Id.* at 18. The Patent Owner maintained the afore-referenced amendments to apparatus claims 1, 2 and 14 directed to the purpose thereof. See *id.* at 19 and 21-22. The Examiner thereafter allowed the claims as

amended, citing the purpose limitations as among those that successfully distinguished the claimed invention over the prior art. *See id.* at 7-9.

B. Person of Ordinary Skill in the Art

33. I understand that a person of ordinary skill in the art is a hypothetical person who is presumed to know the relevant prior art. That person has ordinary creativity, is not an automaton, and is capable of combining teachings of the prior art.

34. I understand that the timeframe for evaluating the profile of an ordinarily skilled person is the time of claimed invention. In this case, this would be the time of application, as I have seen no indication of a date of invention earlier than such application. Thus, in July 2008, a person of ordinary skill in the relevant technology – jacketed cables – would have had at least an undergraduate degree in materials science or aligned science / engineering discipline, and at least two years of experience in cable technology. In 2008, I had experience commensurate with one of ordinary skill in the art.

C. Claim Construction

35. I understand that, unless a patent specification evidences an intent on the part of the inventors that a particular term is to have a specialized meaning, all terms are to be afforded their plain and ordinary meaning in the context of the applicable art – in this case, jacketed cables. I have seen no such specialized

meanings set forth in the specification of the '565 Patent, and have therefore used the plain and ordinary meanings of the terms in the subject claims in analyzing the validity of such claims.

36. I also understand that, in the case of apparatus claims, limitations directed to the purpose of an apparatus should not be considered when comparing such claims to the prior art. In my opinion, the limitation “for use in downhole applications relating to hydrocarbon extraction” and “to convey hydraulic fluid,” which were added during reexamination, are statements of purpose, and stand in contrast to other limitations specifying what the claimed tube is “structured” to be, such as “structured to be hermetically sealed, maintain a positive or negative pressure, and is structured for connection to hermetically sealing compression fittings.” Nonetheless, I have considered the validity of the subject claims both with and without the purpose limitations, as set forth herein.

D. The Prior Art

1. The State of the Art

37. The first successful telegraph cable that connected North America with Europe, which went into service in 1866, over 150 years ago. Telegraph cables eventually gave way to higher capacity coaxial cables, which were adopted for subsea use in 1921, with the first system connecting Key West with Havana, Cuba. Ex. 1016. Certain of the earliest cables included a metal (e.g., copper) tape helically

would “with overlapping edges to completely seal the coaxial from attack by all but the smallest marine organisms.”

38. Cables from the 1920s contained armor wires, which were “generally employed where the cable may be been exposed to wave action, bottom currents, rocks, icebergs, ship's anchors, and fishing trawlers. These jacketed cables, while substantially straight in use, were spooled for testing and for storage aboard and deployment from the ship.

39. By the 1930s, submarine cables had progressed in their reliability and performance such that longer length links were envisioned and installed. However, these systems required repeaters that periodically boosted the electrical signal to reach the other end. These repeaters (electrical then, optical now) were spliced into the cable during deployment, necessitating hermeticity of the cable from the water at high sub-sea pressures and from marine organisms, as well as amenability to various connectors and compression fittings that preserved the ruggedness of the cable under the harsh environments.

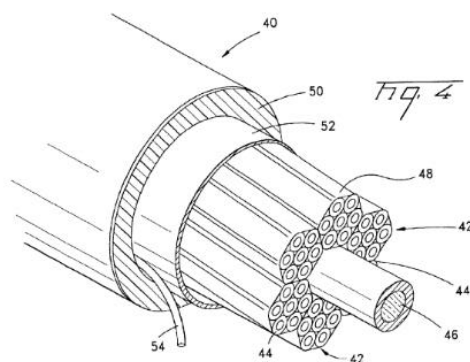
40. By 1956, the first Transatlantic Telephone (TAT-1) cable was operational, connecting Canada with Scotland and employing numerous flexible repeaters. The 1960s and 1970s saw the invention and maturation of the laser and low loss glass optical fiber, which combined to usher in the age of optical fiber communications with TAT-8 being the first network to employ optical fiber cables

in 1988. Optical amplification first replaced electronic amplification in 1995 with transpacific cable TPC5-N and with TAT-12 and TAT-13 in 1996.

41. Telecommunications remains the dominant use of fiber cables but their deployment into other harsh environments, such as in aerospace, automotive, and down-hole applications has expanded. Indeed, even current terrestrial uses benefit from the same evolution in cable design and materials. Examples of such ruggedized uses include rodent- and lightning-proof premise and aerial cables as well as anti-shark-bite marine cables.

42. The development of hermetic and ruggedized communication cables permitted their use in other extreme environments, such as down-hole. As noted by Gysling (2002), “[d]ownhole measurements play a critical role in the production of oil and gas reservoirs: Parameters such as pressure, temperature and fluid flow provide valuable insights into the depletion dynamics of a reservoir that, if optimized, can be highly beneficial to the productivity & economics of the well. Unfortunately, oil and gas reservoirs represent some of the harshest, least accessible, environments on earth.” In the case of down-hole applications, the cables comprise means of sensing well properties, such as pressure and temperature, as well as means to convey that information to external electronics (telemetry). Ex. 1015 at 43.

43. As of the 2008 priority date for the '565 Patent, the major components of the invention claimed therein – a jacketed metal tube with a ripcord – were well known. Indeed, as discussed above, the *Hurley* reference at issue in the Reexamination proceeding depicted all three of those elements clearly in a single figure:



44. *Hurley* is not alone in this disclosure. Similar structure has been repeatedly disclosed in the annual Proceedings of the International Wire and Cable Symposium (“IWCS”). For example, the following, depicting a coated metal tube with a ripcord, appeared in the compendium of papers in the 1991 edition of the IWCS Proceedings:

4. LT cable with welded aluminum tube and PE sheath

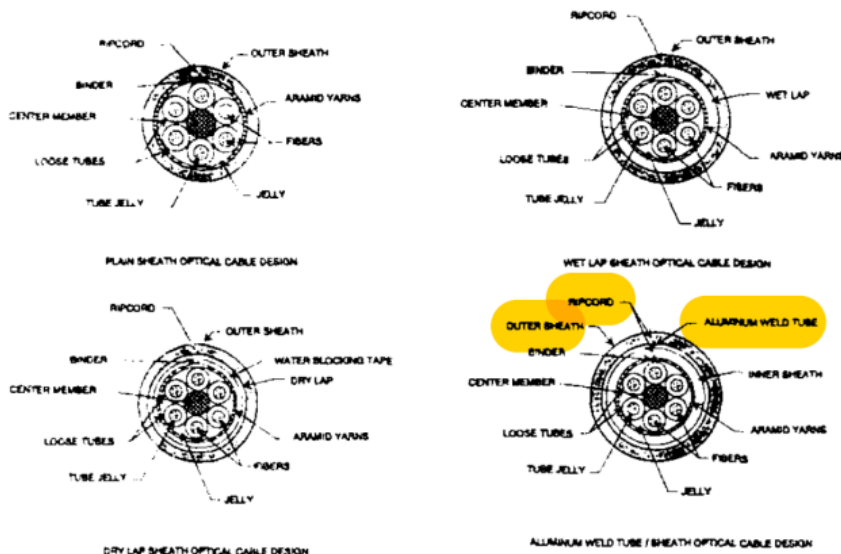
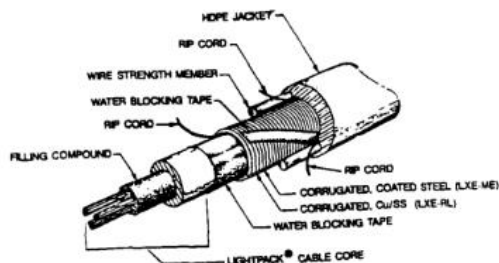


FIG. 5 DIFFERENT LOOSE TUBE OPTICAL CABLE DESIGN

Ex. 1012 at 59.

45. This was not even the sole depiction of the subject structure from the compendium that year, as shown below:

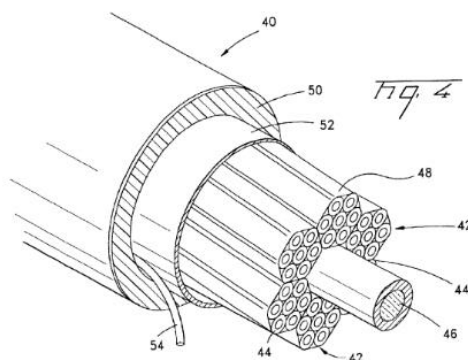


Ex. 1013 at 329.

2. *Hurley*

46. *Hurley* addressed the challenge of increasing the optical fiber count of a single fiber optic cable. Ex. 1004, col. 1, lines 25-26. It accomplished this by bundling optical fibers, and surrounding the bundle with a “separation layer,” which, in turn, is surrounded by a “jacket.” Ex. 1004, col 3, lines 22-31. The structure also has a “ripcord” for “facilitating removal of” the jacket. Ex. 1004, col. 5, lines 2-3.

47. Figure 4 of *Hurley* depicts an embodiment of the invention described and claimed in that patent:

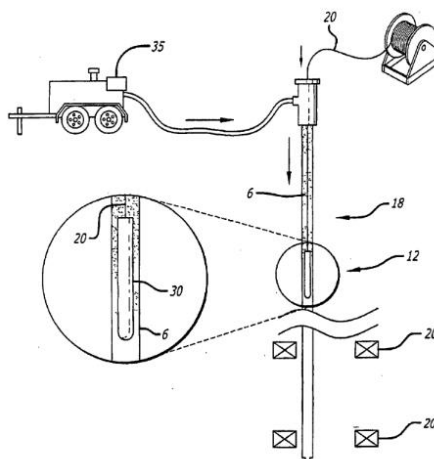


Ex. 1004 at 7.

48. In that figure, element 52 is a “separation layer” that can be formed from “a metal” of “one or more pieces.” *Id.*, col. 10, lines 48-50. In one embodiment taught in *Hurley*, the armor “includes a smooth inner surface.” Ex. 1004, col. 13, lines 30-31. Element 50 in Figure 4 is a “cable jacket” (Ex. 1004, col. 5, line 1) and element 54 is a “ripcord” (*id.*, col. 5, lines 2-3).

3. *Bowker*

49. *Bowker* is generally directed to a “fiber optic sensor assembly capable of deployment down an instrumentation tube located in a well bore,” which, as depicted below, can be spooled:



Ex. 1007 at 1.

50. *Bowker* also teaches: 1) that the tube be hermetically sealed (Ex. 1007, ¶ 0015); 2) pumping a fluid under high pressure into the lumen of the tube disposed within the well bore (*id.*, ¶ [0016]); 3) “[t]he device of the invention is suitable for use in a caustic, high temperature and pressure environment, such as the environment found downhole in an oil or gas well” (*id.*, ¶ [0024]); and 4) continuous pressure maintenance within the tube (*id.*).

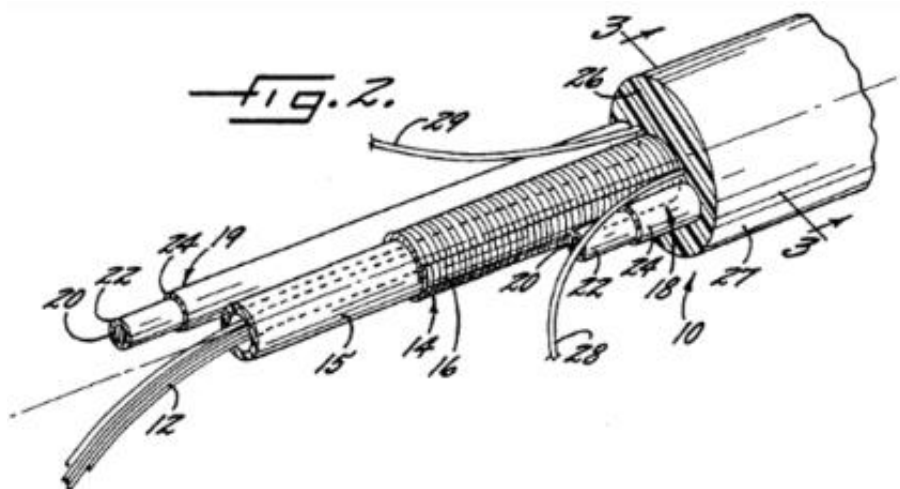
4. *Blew*

51. The invention of *Blew* is directed to “a composite fiber optic and electrical cable having a polymer jacket which is formed around a pair of electrical

conductors and a core containing a number of optical fibers, wherein the jacket can be easily stripped from the electrical conductors in order to facilitate connecting the conductors between a power supply and a signal repeater or other electrical device.”

Ex. 1008, col. 1, lines 54-60.

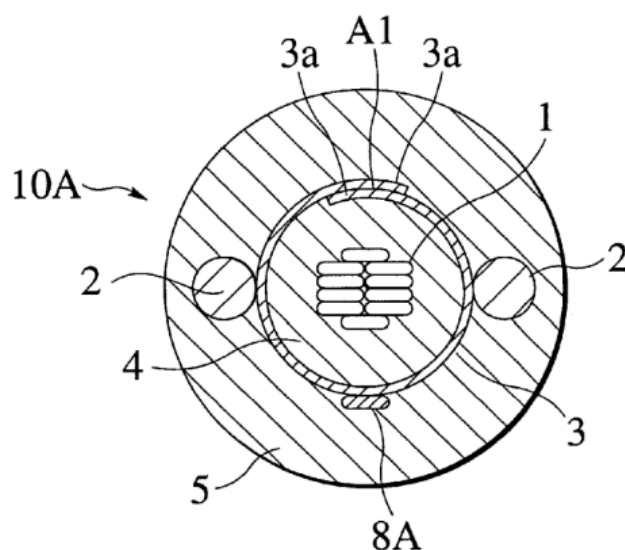
52. Figure 2 of *Blew* shows “wires 18 and 19” that are “surrounded by a jacket 26” (Ex. 1008, col. 4, lines 16-17), and a core 14 containing optical fibers 12 (*id.*, col. 3, lines 36-37):



53. *Blew* solves, *inter alia*, the problem of separate tubes containing electrical connectors and optical fibers, *i.e.*, by having jacketed tubes containing different cable media within the same structure. Ex. 1008, col.1, lines 45-49.

5. *Okada*

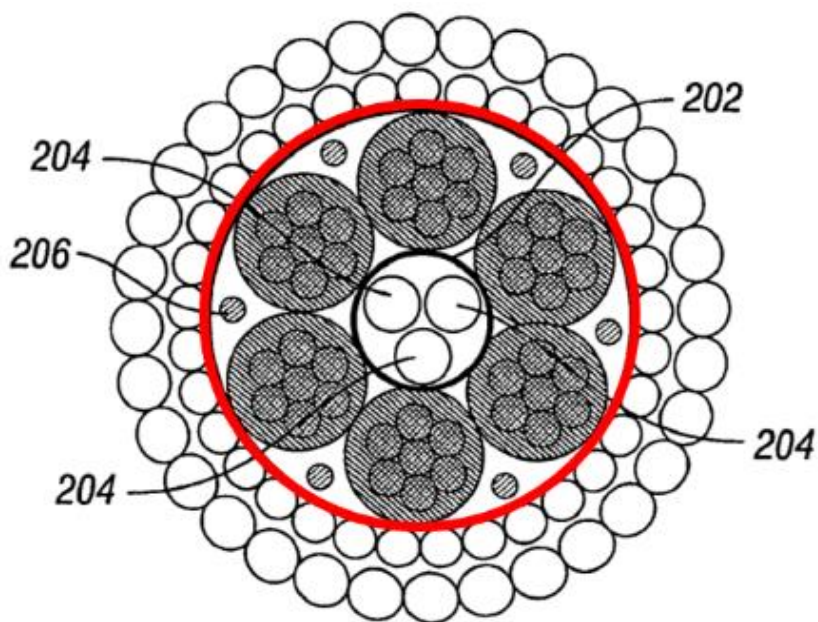
54. *Okada* is generally directed to “an optical-fiber cable capable of being manufactured at lower cost than by the conventional method.” Ex. 1009, col. 2, lines 13-16. *Okada* teaches a “sheath 5” covering “cylinder body 3,” with a “rip cord 8A” disposed between the two, which can be manufactured of various materials, including polymer and metal. Ex. 1009, col. 4, lines 11-23. Figure 1 of *Okada* graphically depicts this arrangement:



Id., col. 3, lines 40-41.

6. *Varkey*

55. *Varkey* describes as “[a] typical technique” introducing “optical fibers into wire line cables is using a metal (i.e. stainless steel) tube to contain the optical fibers, as optical fibers are fragile and prone to damage and degradation.” Ex. 1010, col. 3, lines 40-43. *Varkey* shows the prior art’s use of “a metal tube 202,” which, as noted above, can be made of stainless steel:



Ex, 1010, col. 5, lines 2-4.

7. *Gaillard*

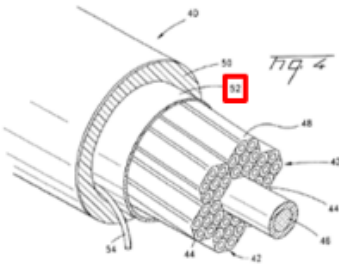
56. *Gaillard* has as an inventive object “a cable assembly in which removal of the protective jacket or sheath can be facilitated by having the ripcords attached to a tape in the cable assembly, which provides access to the underlying core.” Ex. 1011., ¶

[0002]. *Gaillard's* teachings, the ripcord can be disposed through a cable in “a helical fashion.” *Id.*, ¶ [0004].

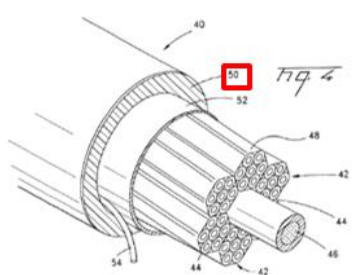
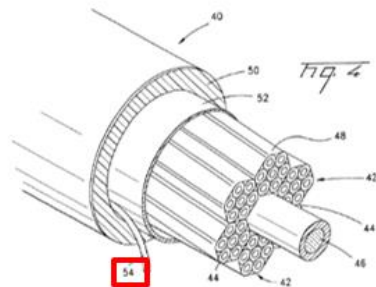
E. The Challenge Grounds

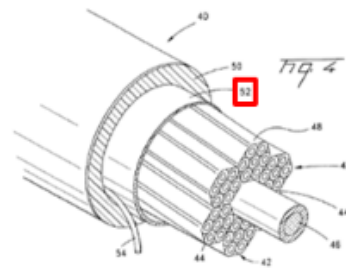
1. Ground No. 1

57. The following chart shows how each limitation of claims 1-5, 11, 13, 18-20 & 22 of the '565 Patent are taught by *Hurley*, and therefore that reference anticipates such claims:

'565 Patent	<i>Hurley</i>
1. A jacketed metal tube comprising a metal tube,	“Separation layer 52 can be formed from by [sic] an armor layer, for example, a metal . . . layer that may be formed from one or more pieces.”²  Ex. 1004, col. 10, lines 48-50 (emphasis added)) and Fig. 4.
a first protective jacket adjoining and surrounding the metal tube,	<i>Hurley</i> shows “[c]able jacket 50” adjoining separation layer 52:

² Contrary to the Patent Owner’s suggestion during reexamination, separation layer 52 in *Hurley's* Figure 4 is not limited to a polyester material, such as MYLAR. See Ex. 1006 at 58-59.

	 Ex. 1004 col. 5, line 1 and Fig. 4.
and a tear cord positioned between the metal tube and the first protective jacket characterized wherein	<i>Hurley</i> shows “ripcord 54” positioned between separation layer 52 and jacket 50 “for facilitating removal of cable jacket 50.”:  Ex. 1004, col. 5, lines 2-3 and Fig. 4.
the protective jacketed metal tube is for use in downhole applications relating to hydrocarbon extraction,	This limitation is directed to intended deployment, and does not count in evaluating patentability.
wherein the protective jacketed metal tube has a wall which is of hollow cylindrical shape and is smooth walled, solid, substantially straight, continuous, without break or interruption,	<i>Hurley</i> teaches that “[s]eparation layer 52 can be formed from by an armor layer, for example, a metal . . . layer that may be formed from one or more pieces,” <i>i.e.</i>, continuous, without break or interruption. Ex. 1006, col. 10, lines 48-50 (emphasis added) and Fig. 4.

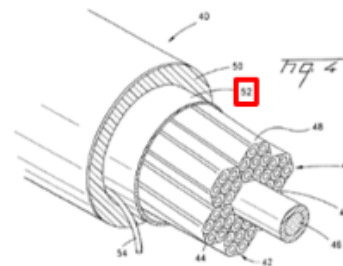


“Separation layer 52 . . . is formed from a flexible armor. The flexible armor preferably includes a smooth inner surface.” Ex. 1004, col. 13, lines 30-31.

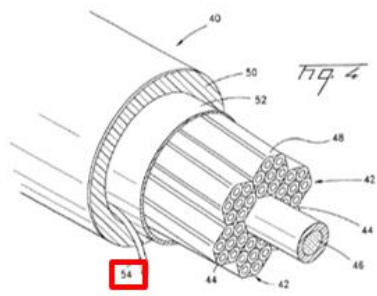
As shown in Figure 4 of *Hurley*, separation layer 52 is a hollow cylinder to accommodate the fiber optic elements. In the embodiments wherein separation layer 52 is metal (Ex. 1004, col. 10, lines 48-50), it is solid.

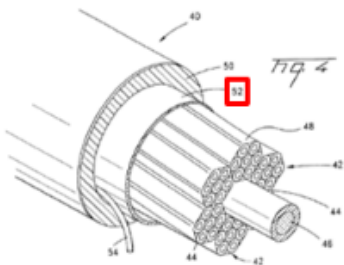
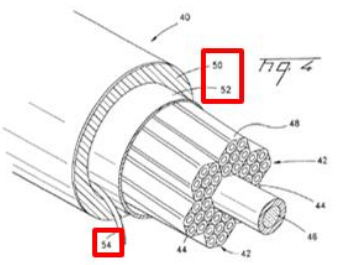
is structured to be hermetically sealed,

As is shown in Figure 4 of *Hurley*, the separation layer 52 is shown as having a round, undeformed tube circumference required for hermetic sealing:

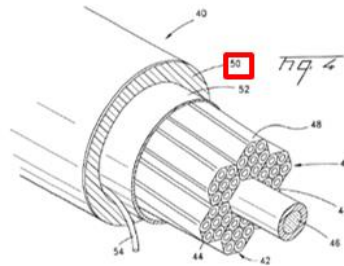


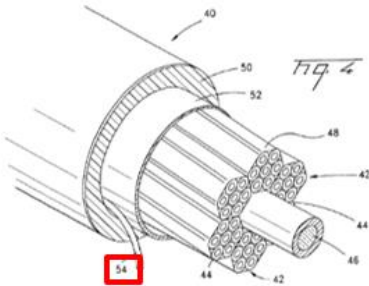
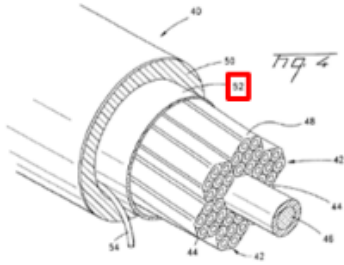
Further, *Hurley* teaches that the separation layer 52 “may provide, for example, crush resistance.” Ex.1004 at 10:46-52.

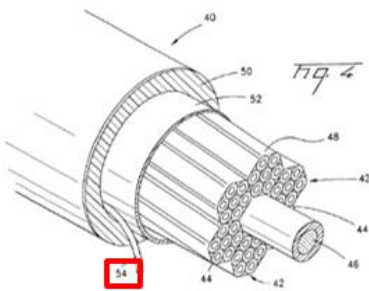
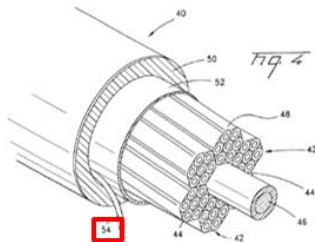
	The Patent Owner argued during reexamination that a round, undeformed tube circumference allows for hermetic sealing. See Ex. 1006 at 62.
maintain a positive or negative pressure,	The tear cord 54 shown in Figure 2 of <i>Hurley</i> avoids the gouges and nicks would otherwise result in pressure loss:  Ex. 1004, col. 2, lines 21-22 and Fig. 4. The applicant argued during reexamination that nicks and gouges from the use of other than tear cords result in loss in pressure. Ex. 1006 at 143, ¶¶ 4 & 7. See also Ex. 1001, col. 2, lines 21-24 (tying nicks and gouges to loss in pressure).
and is structured for connection to hermetically sealing compression fittings to convey fluids downhole,	As is shown in Figure 4 of <i>Hurley</i>, the separation layer 52 has a round, smooth solid wall, of undeformed metal:

	 Further, Hurley teaches that the separation layer 52 “may provide, for example, crush resistance.” Ex.1004 at 10:46-52. The Patent Owner argued during reexamination that a round, undeformed tube circumference allows for hermetic sealing. See Ex. 1006 at 62.
and in that the tear cord is positioned proximate to an outer surface of the metal tube and inside the diameter of the outer first protective jacket	As shown below, ripcord 54 in <i>Hurley</i> is positioned on the outer surface of separation layer 52, and on the inside wall of jacket 50: 
and is able to be pulled back to create a slit in the first protective jacket	The rip cord 54 in <i>Hurley</i> is able to be pulled back to slit open jacket 50. Ex. 1006 at 143, ¶ 9.
and to allow the first protective jacket to be separated from the metal tube without damage to the metal tube surface.	The resulting slit in jacket 50 in <i>Hurley</i> can be used to remove the jacket without scratches or gouges to the surface of separation layer 52. Ex. 1006 at 143, ¶¶ 4 & 7; Ex. 1003, ¶ 49.

2. A jacketed metal tube of claim 1 wherein	<i>See claim 1, supra.</i>
the tube is to convey hydraulic fluid.	This limitation is directed to intended deployment, and does not count in evaluating patentability.
3. A jacketed metal tube of claim 1 wherein	<i>See claim 1, supra.</i>
the tube conveys chemicals.	This limitation is directed to intended deployment, and does not count in evaluating patentability.
4. The jacketed tube of claim 1 wherein	<i>See claim 1, supra.</i>
the jacket comprises polyamide, polyethylene, ethylene chlorotrifluoroethylene or a thermoplastic elastomer cross linking ethylene propylene diene monomer rubber and polypropylene.	<i>Hurley</i> teaches that jacket 28 may be formed of a blend of PVC and polyethylene. Ex. 1004, col. 1, lines 57-60.
5. The jacketed tube of claim 1 wherein	<i>See claim 1, supra.</i>
the jacket comprises engineered thermoplastic vulcanates, perfluoroalkoxy, polyvinylidene fluoride or fluorinated ethylene propylene.	<i>Hurley</i> teaches that “jacket 28 may be formed of a fluoro-plastic, such as polyvinylidene fluoride.” Ex. 1004, col. 1, lines 57-58.
11. The jacketed tube claim 1 further comprising	<i>See claim 1, supra.</i>
a tear cord placed at a selected location on a length of the tube.	<i>Hurley</i> teaches “ripcord 54 for facilitating removal of cable jacket 54,” meaning that it must be placed on a selected location on a length of the tube to allow such removal. <i>See</i> Ex. 1004, col. 5, lines 2-3.
13. The jacketed metal tube of claim 1 wherein the first protective jacket comprises one or more materials of a group consisting of polyethylene, ethylene chlorotrifluoroethylene, a thermoplastic elastomer cross linking ethylene propylene diene monomer rubber and polypropylene,	<i>Hurley</i> discloses forming the jacket 50 of polyethylene (Ex. 1004, col. 8, lines 15-31) or polyvinylidene (<i>id.</i> , col. 1, lines 48-62).

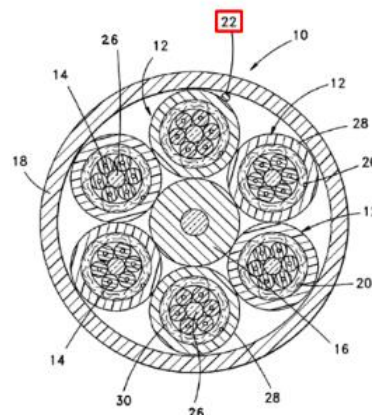
perfluoroalkoxy, polyvinylidene fluoride and fluorinated ethylene propylene,	
and wherein the material is extruded onto the metal tube without radiation curing.	<i>Hurley</i> discloses extruding the jacketing material onto the tube (Ex. 1004, col. 1, line 62 – col. 2, line 18 & col. 8, lines 49-61) without using ultraviolet light (<i>id.</i> , col. 2, lines 4-45 & col. 6, lines 12-15).
18. A method of conveying fluids into a wellbore, the method comprising:	I understand that the preamble is non-limiting.
i. placing a first outer protective jacket around a metal tube to form a jacketed tube which is spoolable,	<i>Hurley</i> shows that cable jacket 50 surrounds separation layer 52 that can be formed of a metal (Ex. 1004, col. 10, lines 48-50):  Ex. 1004, col. 5, line 1 & col. 10, lines 48-50; Ex. 1003, ¶ 55.
the metal tube having a wall which is of hollow cylindrical shape and is smooth, solid, substantially straight, continuous, without break or interruption,	In <i>Hurley</i>, “[s]eparation layer 52 can be formed from by an armor layer, for example, a metal . . . layer that may be formed from one or more pieces,” <i>i.e.</i>, continuous, without break or interruption. Ex. 1004, col. 10, lines 48-50 (emphasis added). “layer 52 . . . is formed from a flexible armor. The flexible armor preferably includes a smooth inner surface.” Ex. 1004, col. 13, lines 30-31.

	As shown in Figure 4 of <i>Hurley</i>, separation layer 52 is a hollow cylinder to accommodate the fiber optic elements. 
capable of being hermetically sealed and suitable for connection to hermetically sealing compression fittings to convey fluids under positive or negative pressure downhole,	As is shown in Figure 2 of <i>Hurley</i>, the separation layer 52 is shown as having a round, undeformed tube circumference required for hermetic sealing.  Further, <i>Hurley</i> teaches that the separation layer 52 “may provide, for example, crush resistance.” Ex.1004 at 10:46-52. The Patent Owner argued during reexamination that a round, undeformed tube circumference allows for hermetic sealing. See Ex. 1006 at 62. The tear cord 54 shown in Figure 2 of <i>Hurley</i> avoids the gouges and nicks

	would otherwise result in pressure loss (col. 2, lines 21-22):  The applicant argued during reexamination that nicks and gouges from the use of other than tear cords result in loss in pressure. Ex. 1006 at 143, ¶¶ 4 & 7. See also Ex. 1001, col. 2, lines 21-24 (tying nicks and gouges to loss in pressure).
ii. placing a tear cord proximate to an outer surface of the metal tube and inside the first protective jacket,	Hurley shows “ripcord 54” (col. 5, lines 2-3) positioned between separation layer 52 and jacket 40: 
and iii. pulling the tear cord back to create a slit in the first protective jacket to allow the first protective jacket to be separated from the metal tube without damage to the metal tube surface.	The rip cord 54 is able to be pulled back to slit open jacket 50. Ex. 1006 at 143, ¶ 9. The resulting slit in jacket 50 can be used to remove the jacket without scratches or gouges to the surface of separation layer 52. <i>Id.</i>, ¶¶ 4 & 7.
19. The method of claim 18 further comprising	See claim 18, <i>supra</i>.
placing a second tear cord adjacent to the outer surface of the first protective jacket	Hurley depicts a “conventional fiber optic cable” (Ex. 1004, col. 4, lines 6-

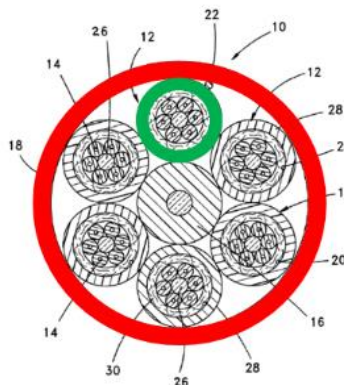
8) with “a cable jacket 18 extruded about the bundles 12 of optical fibers 14, and an optional ripcord 22 for facilitating removal of cable jacket 18” (*id.*, col. 1, lines 30-32). “Each bundle 12 of optical fibers 14 further includes a jacket 28 that surrounds the plurality of optical fibers, and an optional ripcord 20 for facilitating removal of jacket 28” (*id.*, col. 1, lines 50-53).

In this configuration, ripcord 22 for removal of jacket 18 is adjacent to the outer surface of jacket 28:



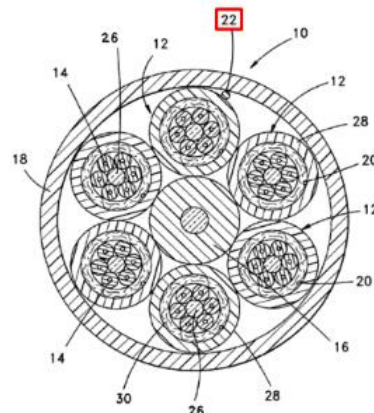
and covering the first protective jacket with a second protective jacket.

In *Hurley*, Jacket 18 (red) covers jacket 28 (green):

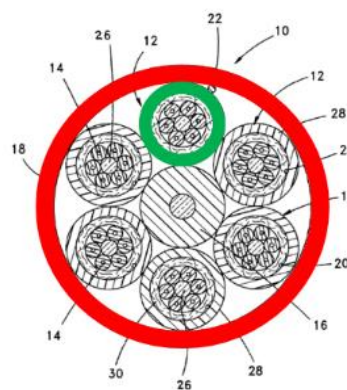


Ex. 1004, Fig. 1.

20. The method of claim 18 wherein the first protective jacket comprises one or more materials of the group consisting of polyethylene, ethylene chlorotrifluoroethylene, a thermoplastic elastomer cross linking ethylene propylene diene monomer rubber and polypropylene, perfluoroalkoxy, polyvinylidene fluoride fluorinate ethylene propylene.	See claim 18, <i>supra</i> . Jacket 28 may be formed of a blend of PVC and polyethylene. Ex. 1004, col. 1, lines 57-60.
22. The tube of claim 1 further comprising a second protective jacket and a second tear cord, wherein the second protective jacket surrounds the first protective jacket, and the second tear cord is positioned between the outer diameter of the first protective jacket and the inner diameter of the second protective jacket.	See claim 1, <i>supra</i> . <i>Hurley</i> depicts a “conventional fiber optic cable” (Ex. 1004, col. 4, lines 6-8) with “a cable jacket 18 extruded about the bundles 12 of optical fibers 14, and an optional ripcord 22 for facilitating removal of cable jacket 18” (<i>id.</i> , col. 1, lines 30-32). “Each bundle 12 of optical fibers 14 further includes a jacket 28 that surrounds the plurality of optical fibers, and an optional ripcord 20 for facilitating removal of jacket 28” (<i>id.</i> , col. 1, lines 50-53). In this configuration, ripcord 22 for removal of jacket 18 is between the outer diameter of jacket 28 and the inner diameter of jacket 18:



In *Hurley*, Jacket 18 (red) covers jacket 28 (green):



Ex. 1004, Fig. 1.

2. Ground No. 2

58. In the event argues that *Hurley* fails to teach the limitations “the protective jacketed metal tube has a wall which is of hollow cylindrical shape and is smooth walled, solid, substantially straight, continuous, without break or interruption” (claim 1), and “the metal tube having a wall which is of hollow cylindrical shape and is smooth, solid, substantially straight, continuous, without

break or interruption” (claim 18), I provide my opinion in the alternative that *Hurley* renders those limitations obvious.

59. Figure 4 of *Hurley* teaches that the separation layer 52 shown in Figure 4 can be made of metal. It is also clear that the separation layer shown in Figure 4 is not the CPID interlock armor embodiment depicted in Figure 8. Where the separation layer is to be made of metal per the teachings of *Hurley*, a person of ordinary skill in the art would have known in July 2008 to manufacture a smooth, solid, substantially straight, continuous tube that is without break or interruption, as such a geometry is easier to manufacture than products with more complex geometries, *e.g.*, corners and uneven surfaces.

60. Further, a circular, smooth surface makes conveyance of fluid more efficient. geometric variations in the tube interior may cause fluid turbulence, impeding conveyance of the optical fiber. Thus, even if the subject limitations from claims 1 and 18 were somehow missing from *Hurley*’s express teachings, they would have been obvious to incorporate in a cable product practicing the remaining teachings from that reference.

3. Ground No. 3

61. In the event that Petitioner argues that the subject claims are limited to fluid delivery in a downhole application, despite those limitations being directed to the purpose of the claimed apparatus, or that the preamble of claim 18 directed to

“[a] method of conveying fluids into a wellbore,” it is my opinion that one of ordinary skill in the art would have looked to prior art references in that specific field, such as *Bowker*, to solve for the problems facing the inventors of the ‘565 Patent.

62. The ‘565 Patent’s stated Field of Use is “tubes used in hydrocarbon production down hole environments.” Ex. 1001, col. 1, lines 6-7. *Bowker*’s Field of Invention is “deploying fiber optic sensors into hostile environments such as down well bores.” Ex. 1007, ¶ [0003]. The substantial similarity between these fields indicates that one facing the problem confronted by the inventors of the ‘565 Patent would have been motivated to consult *Bowker* for the downhole-specific application.

63. *Bowker* supplies the purpose-specific limitations of the ‘565 Patent, to the extent such limitations are relevant to an invalidity analysis, as shown below:

‘565 Patent	<i>Bowker</i>
(Claim 1) the protective jacketed metal tube is for use in downhole applications relating to hydrocarbon extraction,	<i>Bowker</i> pumping a fluid under high pressure into the lumen of the tube disposed within the well bore. Ex. 1007, ¶ [0016].
(Claim 2) the tube is to convey hydraulic fluid.	<i>Bowker</i> pumping a fluid under high pressure into the lumen of the tube disposed within the well bore. Ex. 1007, ¶ [0016].
(Claim 3) the tube conveys chemicals.	In addition to water, <i>Bowker</i> teaches pumping “common silicone oils,” which are chemicals, into the well bore. Ex. 1007, ¶ [0026].
(Claim 18) A method of conveying fluids into a wellbore, the method comprising:	<i>Bowker</i> pumping a fluid under high pressure into the lumen of the tube

	disposed within the well bore. Ex. 1007, ¶ [0016].
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64. Further, to the extent the structure of the claimed jacketed metal tube does not impart the performance limitations of the '565 Patent, *i.e.*, maintaining pressure and hermetic sealing, *Bowker* obviously provides those limitations as well:

'565 Patent	<i>Bowker</i>
(Claim 1) is structured to be hermetically sealed,	<i>Bowker</i> teaches that the tube is hermetically sealed Ex. 1007, ¶ [0015].
(Claim 1) maintain a positive or negative pressure,	<i>Bowker</i> teaches that continuous pressure is maintained in the tube. Ex. 1007, ¶ [0024].
(Claim 1) and is structured for connection to hermetically sealing compression fittings to convey fluids downhole,	<i>Bowker</i> teaches a fitting designed to allow the tubing to be pressurized. Ex. 1007, ¶ [0026]. <i>Bowker</i> pumping a fluid under high pressure into the lumen of the tube disposed within the well bore. Ex. 1007, ¶ [0016].
(Claim 18) placing a first outer protective jacket around a metal tube to form a jacketed tube which is spoolable,	<i>Bowker</i> teaches a flexible tubing assembly for storage spooling and unspooling during fiber optic cable deployment. Ex. 1007, ¶ [0013].
(Claim 18) capable of being hermetically sealed and suitable for connection to hermetically sealing compression fittings to convey fluids under positive or negative pressure downhole,	<i>Bowker</i> teaches that the tube is hermetically sealed Ex. 1007, ¶ [0015]. <i>Bowker</i> teaches a fitting designed to allow the tubing to be pressurized. Ex. 1007, ¶ [0026]. <i>Bowker</i> pumping a fluid under high pressure into the lumen of the tube

	disposed within the well bore. Ex. 1007, ¶ [0016].
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4. Ground No. 4

65. As I note above, during reexamination of the ‘565 Patent, the Patent Owner identified “the” problem addressed by the invention of that patent as including safely removing a protective jacket without damaging the underlying tube surface, which the inventors solved by the deployment of a tear cord. See Ex 1006 at 81.

66. As I explained above, *Hurley* teaches using a ripcord to facilitate removal of a protective jacket from an underlying tube. See Ex. 1004, col. 5, lines 2-3. As *Hurley’s* teaching is silent as to the appropriate materials for such ripcord, a person of ordinary skill in the art would have been motivated to look to the teachings of references such as *Okada* regarding such materials.

67. The following shows how *Hurley* as modified by *Okada’s* teachings obviously results in the subject matter of claims 6 and 9 of the ‘565 Patent:

Claims	<i>Hurley in Light of Okada</i>
6. The jacketed tube of claim 1 further comprising	See claim 1, <i>supra</i> .
a tear cord made of poly-aramid fiber.	<i>Okada</i> discloses the use of ripcords that are made from aramid fiber. Ex. 1009, col. 7, lime 28.

	Modifying <i>Hurley's</i> teachings with those of <i>Okada</i> results in <i>Hurley's</i> ripcord made of an aramid fiber.
9. The jacketed tube of claim 1 further comprising:	See claim 1, <i>supra</i> .
a tear cord made of metal.	<i>Okada</i> discloses the use of ripcords that are made from steel wire. Ex. 1009, col. 7, line 29. Modifying <i>Hurley's</i> teachings with those of <i>Okada</i> results in <i>Hurley's</i> ripcord made of metal.

5. Ground No. 5

68. Starting with *Hurley's* teaching that separation layer can be made of metal (Ex. 1004, col. 10, lines 48-50), that reference is silent as to the type of metal to be used. Thus, one looking to practice *Hurley's* teachings would have been motivated to turn to references such as *Varkey*, which describes as “[a] typical technique” introducing “optical fibers into wire line cables is using a metal (*i.e.* stainless steel) tube to contain the optical fibers, as optical fibers are fragile and prone to damage and degradation.” Ex. 1010, col. 3, lines 40-43.

69. Logically, one skilled in the art would not have been inclined to experiment with new materials to combine with *Hurley's* teachings when known, “typical” techniques in the same field of endeavor (optical fiber technologies) were available.

70. The following chart shows the result of modifying *Hurley's* teachings with those of *Varkey* rendering obvious claim 7 of the '565 Patent:

Claim	<i>Hurley in light of Varkey</i>
7. The jacketed tube of claim 1 wherein the solid wall metal tube comprises incoloy, stainless steel, carbon steel, or galvanized carbon steel.	See Claim 1, <i>supra</i>. “A typical technique to introduce optical fibers into wire line cables is using a metal (<i>i.e. stainless steel</i>) tube to contain the optical fibers, as optical fibers are fragile and prone to damage and degradation.” Ex. 1010, col. 3, lines 41-44 (emphasis added). Modifying <i>Hurley's</i> teachings with those of <i>Varkey</i> results in the separation layer 52 made out of stainless steel.

6. Ground No. 6

71. One of ordinary skill in the art reading *Hurley* would have known to use a ripcord to remove a protective jacket from an underlying tube. See Ex. 1004, col. 5, lines 2-3. However, *Hurley* is agnostic as to the configuration of the ripcord.

72. *Gaillard* is directed to “a cable assembly in which removal of the protective jacket or sheath can be facilitated by having the ripcords attached to a tape in the cable assembly, which provides access to the underlying core.” Ex. 1011, ¶ [0002]. One looking to practice *Hurley's* teachings would have turned to *Gaillard* to discern different manners of deploying a ripcord, which, in the case of *Gaillard*, includes in “a helical fashion.” *Id.*, ¶ [0004].

73. The following is a chart that shows how one obviously arrives at claim 10 of the '565 Patent by modifying *Hurley's* teachings in light of *Gaillard*:

10. The jacketed metal tube of claim 1 wherein the tear cord is helically wound around the tube.	<i>Gaillard</i> discloses that ripcords can be disposed “through the cable . . . in a helical fashion.” Ex. 1011, ¶ [0004]. Modifying <i>Hurley's</i> teachings with those of <i>Gaillard</i> results in a ripcord disposed in a helical fashion around the tube to facilitate the removal of the protective jacket therefrom.
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7. Ground No. 7

74. As I note above, *Hurley* addressed the challenge of increasing the optical fiber count of a single fiber optic cable. Ex. 1004, col. 1, lines 25-26. *Blew* solves the problem of separate tubes containing electrical connectors and optical fibers, *i.e.*, by having tubes containing different cable media within the same jacketed structure. Ex. 1008, col.1, lines 45-49. The two references have in common an aim toward maximizes design efficiency in cables. A feature that would have been intuitive to one of ordinary skill in the art in 2008 is cable strength. In fact, *Hurley* teaches “a central strength member along which optical fibers 44 extend.” Ex. 1004, col. 11, lines 14-15.

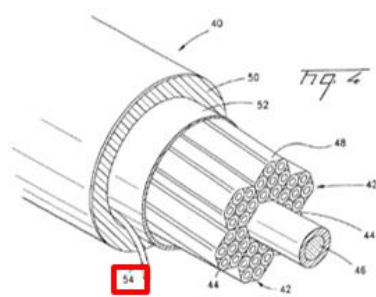
75. One reading *Hurley's* teachings would have been motivated to explore possible materials for enhancing cable strength, and, in that regard, *Blew* teaches electrically conductive wires that “include a steel center or core” which “serves to

strengthen the cable longitudinally and to stiffen the cable, thus further reducing bending stresses imparted upon” the optical fibers. Ex. 1008, col. 3, lines 59-64; There would, therefore, have been a motivation to modify *Hurley*’s teachings with those of *Blew* to arrive at the claimed invention.

76. Further, given the aim of both references to maximize cable design efficiency, one of ordinary skill reading *Hurley* would have been motivated to consider the multi-media cable configuration within one jacket described in *Blew* in order to modify *Hurley*’s teachings. See Ex. 1008, col.1, lines 45-49; Ex. 1003, ¶ 102.

77. The following chart shows this resulting combination in the context of claims 12, 14 and 15 of the ‘565 Patent, rendering those claims obvious:

Claim	<i>Hurley in Light of Blew</i>
12. A jacketed metal tube of claim 1 further comprising	See claim 1, <i>supra</i> .
one or more steel ropes within one or more protective jackets surrounding the metal tube	<i>Blew</i> teaches electrically conductive wires that “include a steel center or core” which “serves to strengthen the cable longitudinally and to stiffen the cable, thus further reducing bending stresses imparted upon” the optical fibers. Ex. 1008, col. 3, lines 59-64. <i>Hurley</i> teaches “a central strength member along which optical fibers 44 extend.” Ex. 1004, col. 11, lines 14-15. It also teaches that jacket 50 “generally surrounds strength members.” Ex. 1004, col. 12, line 38.

	Modifying <i>Hurley's</i> teachings with those of <i>Blew</i> results in a steel strength member within jacket 50 along which the optical fibers disposed within separation layer 52 would extend.
and one or more tear cords wherein at least one tear cord is positioned next to each steel rope and metal tube	<i>Hurley</i> shows “ripcord 54” positioned between separation layer 52 and jacket 50:  Ex. 1004, col. 5, lines 2-3 and Fig. 4. As the steel strength member from <i>Blew</i> would be within <i>Hurley's</i> jacket 50, <i>Hurley's</i> ripcord 54 would be next to such steel strength member.
wherein each steel rope has the same axis of orientation as the metal tube and is positioned adjacent to the metal tube within the one or more protective jackets	As noted above, the steel strength member from <i>Blew</i> would be within jacket 50, meaning it necessarily would be oriented in same axis as the separation layer 52, and positioned next to such separation layer.
whereby each tear cord can be pulled back to create a slit in the one or more protective jacket	The rip cord 54 in <i>Hurley</i> is able to be pulled back to slit open jacket 50. Ex. 1006 at 143, ¶ 9.
and to allow the one or more protective jackets to be separated from each steel rope and metal tube without damage to the metal tube surface.	The resulting slit in jacket 50 in <i>Hurley</i> can be used to remove the jacket without scratches or gouges to the surface of separation layer 52. Ex. 1006 at 143, ¶¶ 4 & 7.
14. An encapsulated cable comprising a protective jacket in which the protective	<i>Hurley</i> teaches a cable 40 that includes a jacket 50 covering a “separation

jacket surrounds a plurality of solid wall metal tubes,

layer” 52 (col. 10, lines 21-24), which can be formed from by an armor layer, for example, **a metal** . . . layer that may be formed from one or more pieces.” Col. 10, lines 48-50 (emphasis added).

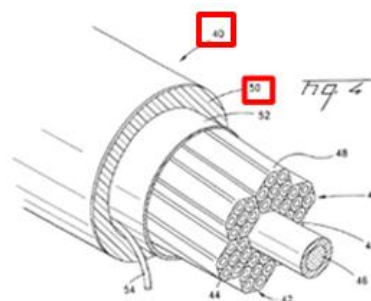
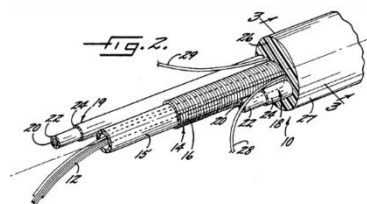


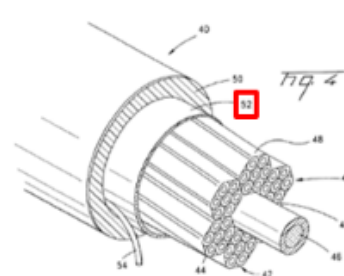
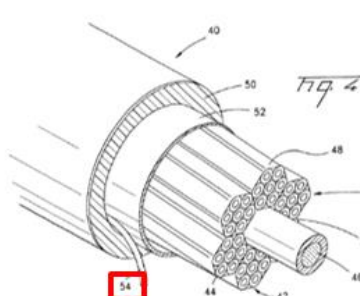
Figure 2 of *Blew* shows “two electrically conductive wires 18 and 19” (Ex. 1008, col. 3, lines 49-50), with “a steel center or core 20 and a surrounding layer of copper cladding 22,” *i.e.*, a tube (*id.*, col. 3, lines 60-61), and “wires 18 and 19 are in turn surrounded by a jacket 26” (*id.*, col. 4, lines 16-17).

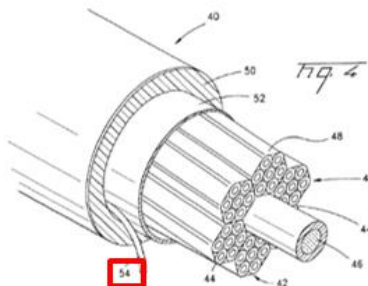


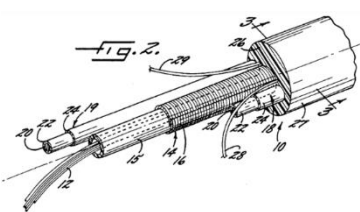
Modifying Hurley with the teachings of *Blew* results in a multiplicity of separation layers (tubes) covered by a jacket.

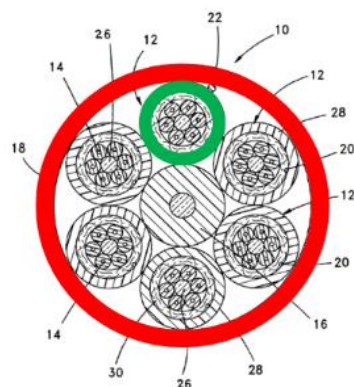
and wherein each metal tube has a parallel axis of orientation with the other tube or tubes

Blew shows wires 18 and 19 have “their centers located along the major axis of the cable's elliptical cross section,” *i.e.*, they are parallel with

	each other. Ex. 1008, col. 5, lines 8-11). Modifying <i>Hurley</i> with the teachings of <i>Blew</i> results in the multiplicity of separation layers that are parallel to one another.
and further wherein the metal tubes comprise smooth metal walls structured to be hermetically sealed, maintain a positive or negative pressure, and are structured for connection to hermetically sealing compression fittings	“Separation layer 52 . . . is formed from a flexible armor. The flexible armor preferably includes a smooth inner surface.” Ex. 1004, col. 13, lines 30-31. As is shown in Figure 4 of <i>Hurley</i>, the separation layer 52 is shown as having a round, undeformed tube circumference required for hermetic sealing:  The tear cord 54 shown in Figure 2 avoids the gouges and nicks would otherwise result in pressure loss (col. 2, lines 21-22): 

	The applicant argued during reexamination that nicks and gouges result in loss in pressure. Ex. 1006 at 143, ¶ 4. <i>See also</i> Ex. 1001, col. 2, lines 21-24 (tying nicks and gouges to loss in pressure).
and whereby at least one tear cords is positioned between the outside surface of at least one metal tube and the inside of said protective jacket	Hurley shows “ripcord 54” (col. 5, lines 2-3) positioned between separation layer 52 and jacket 40: 
whereby the at least one tear cord is oriented longitudinally along the length of the at least one metal tube	Figure 4 shows “ripcord 54” (col. 5, lines 2-3) positioned between separation layer 52 and jacket 40, and oriented longitudinally along the length of the separation layer.
and whereby the at least one tear cord can be pulled back to create a slit in the protective jacket to allow the protective jacket to be separated from the at least one metal tubes without damage to the outside surface of the at least one metal tube.	The rip cord 54 in <i>Hurley</i> is able to be pulled back to slit open jacket 50. Ex. 1006 at 143, ¶ 9. The resulting slit in jacket 50 in <i>Hurley</i> can be used to remove the jacket without scratches or gouges to the surface of separation layer 52. Ex. 1006 at 143, ¶¶ 4 & 7.
15. The encapsulated cable of claim 14 wherein at least one of the metal tubes contains therein a fiber optic cable, electrical wire or data communication cable.	<i>Hurley</i> teaches “bundles 42 of optical fibers 44 may be stranded around an electrical component, for example, a coaxial cable or other Suitable electrical components.” Ex. 1004, col. 10, lines 53-55.

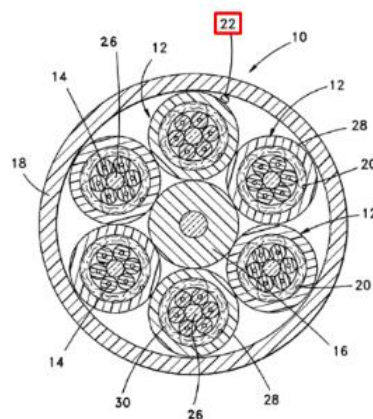
25. The jacketed metal tube of claim I further comprising	See claim 1, <i>supra</i> .
a plurality of substantially straight metal tubes with the same planar axis of orientation	Figure 2 of <i>Blew</i> shows “two electrically conductive wires 18 and 19” (col. 3, lines 49-50), with “a steel center or core 20 and a surrounding layer of copper cladding 22,” <i>i.e.</i>, a tube (col. 3, lines 60-61). Both copper-clad wires are shown to be substantially straight, with the same planar axis of orientation.  Modifying Hurley with the teachings of <i>Blew</i> results in a multiplicity of separation layers (tubes) covered by a jacket.
wherein at least one metal tube is surrounded by a second protective jacket,	<i>Hurley</i> depicts a “conventional fiber optic cable” (Ex. 1004, col. 4, lines 6-8) with “a cable jacket 18 extruded about the bundles 12 of optical fibers 14, and an optional ripcord 22 for facilitating removal of cable jacket 18” (<i>id.</i>, col. 1, lines 30-32). “Each bundle 12 of optical fibers 14 further includes a jacket 28 that surrounds the plurality of optical fibers, and an optional ripcord 20 for facilitating removal of jacket 28” (<i>id.</i>, col. 1, lines 50-53). In <i>Hurley</i>, Jacket 18 (red) covers jacket 28 (green):



Ex. 1004, Fig. 1.

and wherein a second tear cord is located between the first protective jacket and the second protective jacket.

In *Hurley's* configuration, ripcord 22 for removal of jacket 18 is adjacent to the outer surface of jacket 28:



See Ex. 1004, col. 1, lines 30-32.


John Ballato

Dated: 28 April 2023



Curriculum Vitae

JOHN BALLATO

FELLOW AAAS, IEEE, APS, OSA, SPIE, ACERS, NAI, WAC

J. E. Sirrine Endowed Chair of Optical Fiber

Professor of Materials Science and Engineering, Electrical and Computer Engineering, and
Physics & Astronomy

Clemson University
Clemson, SC 29634 USA

Phone: (864) 656-1035
Email: jballat@clemson.edu

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Appendix A: Curriculum Vitae – Dr. John Ballato

SECTION I – EXPERTISE, EDUCATION, AND PROFESSIONAL EXPERIENCE

Scholarly Interests and Expertise

Optical and optoelectronic properties of materials, light-matter interactions, optical fibers and their fabrication, optical ceramics, rare-earth doping for active and passive optical applications. Erdős number = 4; Einstein number = 5.

Education

- Ph.D. Ceramic and Materials Engineering, Rutgers University (1997)
Fiber Optic Materials Research Program; Dissertation: Sol-Gel Synthesis of Rare Earth Doped Halide Optical Materials for Photonic Applications; Advisor: Professor Richard Riman, Fellow ACerS; Member, National Academy of Inventors (NAI) and the World Academy of Ceramics (WAC).
- B.S. Ceramic Science and Engineering, Rutgers University (1993)
Fiber Optic Materials Research Program; Thesis: Fabrication of Optical Fibers with High Rare Earth Concentrations; Advisor: Professor Elias Snitzer; Member, National Academy of Engineering, Fellow OSA, ACerS.

Academic Experience (Clemson University, Clemson, SC USA)

- J. E. Sirrine Endowed Chair of Optical Fiber (Inaugural; 2015 – present)
- | | |
|---------------------|---|
| Academic Director | Clemson University Restoration Institute (2013 – 2014) |
| Professor | Physics and Astronomy (2021 – present) |
| Professor | Electrical and Computer Engineering (2009 – present) |
| Professor | Materials Science and Engineering (2007 – present) |
| Associate Professor | Materials Science and Engineering (2002 – 2007) |
| Assistant Professor | Department of Ceramic and Materials Engineering (1997 – 2002) |

Professional Experience and Administrative Appointments

- Director, AVX Corporation (2019 – 2020; when public shares sold to Kyocera)
 - Elected by shareholders as one of three independent Directors. Serve on AVX’s Audit Committee, Compensation Committee, and Special Advisory Committee. Chair of the Special Advisory Committee to the CEO.
 - AVX Corporation (NYSE: AVX) is a leading international manufacturer and supplier of advanced electronic components with 29 manufacturing facilities in 16 countries with 15,000 global employees and a ~ \$3B market capitalization.
 - Elected member of 3-person Special Committee to valuate and negotiate acquisition of AVX’s public shares by Kyocera (2019 – 2020).
- Vice President for Economic Development, Clemson University (2014 –2015)
 - Institutional official responsible for Clemson University’s economic development activities including 3 innovation campuses (over \$700M of public/private investment and about \$22M in annual budgetary commitments), business development and industry partnerships, and teaming with State and regional economic development organizations to recruit corporations to the State.
 - Member of the University’s administrative council, which represents the institution’s executive officers as well as the University’s conflict of interest, governmental priorities, and enterprise data management committees. Active participant in University budget process and priorities.

Appendix A: Curriculum Vitae – Dr. John Ballato

- Vice President for Research (Interim), Clemson University (2010)
 - Institutional official responsible for the University’s research administration including research compliance, research safety, research services, sponsored programs, technology transfer, grants and contracts administration, and the University research grant committee.
 - Member of the University’s administrative council, which represents the institution’s executive officers.
- Associate Vice President for Research and Economic Development, Clemson University (2007 –2011)
 - University-wide “champion” for research and economic development with a particular focus in advanced materials, especially exploring opportunities for major collaborative research initiatives, and facilitating the formation of inter-disciplinary research teams.
- Faculty Representative to the Board of Trustees, Clemson University (2006 – 2008)
 - Served as the principal liaison with the University Board of Trustees on all matters affecting the faculty.
- Principal Investigator, SmartState Center of Economic Excellence in Optical Materials, Clemson University (2004 – present)
 - Proposed, fund-raised, and have managed since its founding, the \$10M *SmartState Center of Economic Excellence in Optical Materials*, which is one of the South Carolina Research Centers of Economic Excellence.
- Director, Center for Optical Materials Science and Engineering Technologies (COMSET) Clemson University (2000 – 2014)
 - Co-founded and directed this research unit of the College of Engineering and Science.
 - Grew center from 4 junior faculty initially into Clemson’s most research active center with 40 participating faculty, sponsored research expenditures of about \$5M / year, 600+ publications and 6000 citations. This represented, at that time, about 10% of all of Clemson’s journal publications, 8% of its journal citations, and (a 5 year average of) 8% of Clemson’s research expenditures.
- Instructor, Fiber Optic Technologies, Somerset County Technical Institute (1996 – 1997; Somerset, NJ)
 - While pursuing the PhD, taught several courses on fiber optic systems analysis, design, and troubleshooting to technical college students as part of a certificate program for early generation fiber optic network installers.

Entrepreneurial Experience

- Co-Founder, Tetramer Technologies, LLC (2001 - present); the story of Tetramer’s founding and growth was documented in *ACORN: Entrepreneurial Narrative and History*; ISBN: 978-0-9842598-2-3. Sold controlling interest in Tetramer in 2021.
- Co-Founder, AEOS Fiber Optics (2010 – 2011).
- Co-Founder, South Mechanic Street Group (2013 – 2022; sold 2022).
- Board Member (Private Corporations)
 - Tetramer Technologies (Pendleton, SC; 2001 – present).
 - Emerald Endeavors LLC (Greenville, SC; 2012 – 2015).
 - Layer Metrics LLC (Princeton, NJ; 2020 – present).

Honors and Awards

- Major Honors and Awards – International / National

Appendix A: Curriculum Vitae – Dr. John Ballato

- **Fellow**, *American Association for the Advancement of Science* (AAAS, 2019), for “distinguished contributions to the field of optical fiber and optoelectronic materials; most notably the development of semiconductor and crystal-derived optical fibers.”
- **Fellow**, *American Physical Society* (APS, 2020), for “pioneering contributions to optical fibers, most notably to novel fiber optic materials and their fabrication.”
- **Fellow**, *Institute of Electrical and Electronics Engineers* (IEEE, 2017), for “contributions to optical fibers and optoelectronic materials.”
- **Fellow**, *Optical Society of America* (OSA, 2012), for “research on optical and optoelectronic materials and fibers both directly and through his formation and direction of the Center for Optical Materials Science and Engineering Technologies at Clemson University.”
- **Fellow**, *International Society of Optical Engineering* (SPIE, 2011), for “achievements in novel optical materials and optical fibers.”
- **Fellow**, *American Ceramic Society* (ACerS, 2009).
- **Fellow**, *US National Academy of Inventors* (NAI, 2015).
- **Academician**, *World Academy of Ceramics* (WAC, 2015), for “pioneering advances in optical fibers, glasses, and ceramics. Distinguished leadership and service to the field of glasses and optical materials.” Global membership limited to < 300 individuals.
- **George W. Morey Award**, *American Ceramic Society* (2022), recognizing “new and original work in the field of glass science and technology.”
- **William Streifer Scientific Achievement Award**, *IEEE Photonics Society* (2022), for “pioneering contributions to the science, engineering, and application of optoelectronic fibers.”
- **Arthur L. Friedberg Ceramics Engineering Award**, *American Ceramic Society* and *National Institute of Ceramic Engineering* (2014); recognizes “an outstanding contribution to ceramic engineering that has a technological basis relating to the processing or the manufacture of ceramic products.”
- **Richard M. Fulrath Award**, *American Ceramic Society*; recognizes “excellence in research and development of ceramic sciences and materials” (2010).
- **Top Ten Breakthroughs**, *Physics World* magazine (Institute of Physics, 2014), recognition of first realization of transverse Anderson localization in a glass optical fiber [journal publication # 157, “Image Transport through a Disordered Optical Fiber Mediated by Transverse Anderson Localization,” *Nature Communications* 5, 3362 (2014)].
- Author of two (2) of the five (5) articles highlighted in the Optical Fibers and Photonics issue (January 2022) of “[Glass: Then and Now](#),” a collection of American Ceramic Society journal articles “that have played historically critical roles in advancing glass science and technology...” in celebration of the United Nations International Year of Glass 2022.
- Early Career Awards
 - **The Schwartzwalder-PACE Award**, *National Institute of Ceramic Engineers* (2004); citation: “In recognition of the nation’s outstanding young ceramic engineer whose achievements have been significant to the profession and the general welfare of the American people.”
 - **Robert L. Coble Award**, *American Ceramic Society* (ACerS, 2004); citation: “In recognition of the nation’s outstanding young ceramic scientist.”
 - **Robert Lansing Hardy Award**, *The Minerals, Metals & Materials Society* (TMS, 2003); citation: “In recognition of exceptional promise for a successful career in metallurgy or materials science.”
 - **Norbert J. Kreidl Award**, *The Glass and Optical Materials Division* (GOMD) of the *American Ceramic Society* (ACerS, 1997).
- Traveling Lectureships
 - US Advisory Committee to the *International Commission on Optics* (2002).

Appendix A: Curriculum Vitae – Dr. John Ballato

- *Optical Society of America* (2017, 2020).
- Alumni Awards (Rutgers University)
 - *Medal of Excellence for Alumni Achievement in Academia*; citation: “For ground-breaking research, dedication to training the next generation of engineers, and for reflecting great honor on your alma mater” (2009).
 - *Distinguished Alumni Award for Early Career Accomplishments*; citation: “In recognition of his extraordinary contributions to the science and engineering of materials for optical and optoelectronic applications” (2006).
- Major Honors and Awards – Regional / Institutional
 - *Governor’s Award for Excellence in Scientific Research* (2014); “bestowed by the Governor of South Carolina, the Honorable Nikki Haley, on behalf of its citizen’s, and annual recognizes an individual within the state whose achievements and contributions to science in South Carolina merit special recognition and to promote wider awareness of the quality and extent of scientific activity in South Carolina.”
 - *Class of ’39 Award for Excellence*, Clemson University (2014); “presented to one distinguished member of the faculty whose outstanding contributions have been judged by his or her peers to represent the highest achievement of service to the University, the Student Body, and the larger community, whether it be the town, the state, or the nation.”
 - *Liberty Fellow* (Class of 2007); An incubator for exemplary leadership in South Carolina. Fellows of the Aspen Global Leadership Network, who make a lifelong commitment to use their creativity, network, and energy to move South Carolina forward. Mentor: The Honorable David Wilkins; US Ambassador to Canada at the time of mentorship.
- Leadership
 - *Aspen Global Leadership Network Fellow* (2007), Aspen Institute; Member of the AGLN, which is a global network of Fellows who have graduated from the young leadership programs of the Aspen Institute. Have participated, by invitation only, in the following activities of the AGLN:
 - *Aspen Institute Ideas Festival Fellow*, Aspen Institute one of approximately 40 people world-wide to receive a scholarship to attend the Aspen Ideas Festival (Aspen, CO, 2007).
 - *AGLN Inaugural Seminar*, selected as one of 24 AGLN fellows from around the world to participate in the inaugural leadership seminar (Stellenbosch, South Africa, April 2008).
 - Selected as one of 16 AGLN fellows to participate in the “Heroic Spirit” leadership seminar (Athens, Greece, September 2014).
 - *Academy for Innovative Higher Education Leadership Fellow* (inaugural cohort, 2014); an executive leadership program that aspires to be the premier training ground for would-be college presidents or those who aspire to senior leadership positions in higher education, and those who want to lead organizational change at colleges and universities.

SECTION II – SPONSORED RESEARCH SUMMARY

- Over \$50,000,000 in extramural funding as principal investigator (PI), including being PI on \$10,000,000 South Carolina Research Center of Economic Excellence in Optical Materials (2004 to present).
- Over \$5,000,000 in extramural funding as co-principal investigator (funds directly to co-PI).

Principal Investigator Programs

Federal Programs

Department of Defense

Appendix A: Curriculum Vitae – Dr. John Ballato

1. “DURIP: Instrumentation for the Spectroscopic Characterization of Rare-Earth Doped, Low Phonon Energy Host/Polymer Composites for Volumetric Displays” through the US Army, 31-Mar-1999 to 30-Mar-2000; Award Total: **\$178,774**.
2. “Materials and Devices for Optical Sources and Protection of Optical Sensors” through DARPA, 1-Nov-1999 to 31-Oct-2003; Award Total: **\$1,715,502**.
3. “The Laboratory for Advanced Photonic Composites” through DARPA, 19-Jul-2001 to 21-Apr-2010; Award Total: **\$19,104,026**.
4. “Nanocomposite Coatings for Thermal Signature Reduction” through the US Army, 18-Feb-2005 to 17-Mar-2006; Award Total: **\$88,750**.
5. “Active Coating Technology Program” through the US Army, 23-Aug-2005 to 30-Jun-2007; Award Total: **\$2,158,551**.
6. “High Power Fiber Lasers” Joint Technology Office High Energy Laser Multidisciplinary Research Initiative (JTO HEL MRI) through the US Army, 1-Oct-2005 to 31-Dec-2011; Award Total: **\$4,676,547**.
7. “DURIP: Specialty Optical Fiber Fabrication and Test System” through the US Army, 1-May-2007 to 30-Apr-2008; Award Total: **\$102,000**.
8. “ACToR Program” through the US Army, 1-Jul-2007 to 30-Jun-2008; Award Total: **\$190,286**.
9. “Eye-Safe Polycrystalline Lasers” Joint Technology Office High Energy Laser Multidisciplinary Research Initiative (JTO HEL MRI) through the US Air Force, 15-Aug-2007 to 14-Feb-2012; Award Total: **\$2,516,628**.
10. “Light Diffracting Fibers” through the US Army, 1-Oct-2007 to 30-Nov-2008; Award Total: **\$174,241**.
11. “Novel High Energy Fiber Lasers” through the Missile Defense Agency (MDA), 1-Oct-2008 to 30-Sep-2011; Award Total: **\$591,316**.
12. “Strategy for Enhanced Light Output from Luminescent Nanoparticles” through the Defense Threat Reduction Agency (DTRA), 8-Feb-2009 to 7-Feb-2011; Award Total: **\$140,000**.
13. “Luminescence Materials as Nanoparticle Thermal Sensors” through the Defense Threat Reduction Agency (DTRA), 15-Feb-2010 to 21-Feb-2013; Award Total: **\$130,087**.
14. “Novel Materials and Components for All-Fiber Faraday Isolators” through the US Air Force, 31-Aug-2009 to 7-Aug-2012; Award Total: **\$534,942**.
15. “Optical Fibers with Elevated Threshold for Higher Order Mode Instability – Task Order 1,” Joint Technology Office High Energy Laser through the US Air Force, 13-Jan-2015 to 12-July-2016; Award Total: **\$171,098**.
16. “Optical Fibers with Elevated Threshold for Higher Order Mode Instability – Task Order 2,” Joint Technology Office High Energy Laser through the US Air Force; 13-Jan-2016 to 12-July-2017; Award Total: **\$179,507**.
17. “A Unified Materials Approach to Mitigating Nonlinearities in HEL Optical Fibers,” Joint Technology Office High Energy Laser Multidisciplinary Research Initiative (JTO HEL MRI) through the Office of Naval Research, 1-Sep-2017 to 31-Aug-2022; Award Total: **\$2,971,656**.
18. “Materials Development for Novel High Raman Gain Fibers and Power-Scalable Amplifiers,” US Army Research Office Cooperative Agreement, 1-Aug-2022 to 31-July-2025; Award Total: **\$1,019,922**.

National Science Foundation

1. “Graduate Fellowship: Growth and Characterization of Ferroelectric Nitride Semiconductor Heterostructures,” 1-Aug-2002 to 31-Jul-2007; Award Total: **\$59,500**.
2. “Partnerships for Innovation: Economic Excellence in Photonic Materials,” 1-Oct-2003 to 30-Sep-2007; Award Total: **\$540,174**.
3. “Collaborative Research: Novel Laser and Nonlinear Properties of Anderson Localization Optical Fibers,” 15-Aug-2018 to 31-Jul-2021; Award total: **\$200,000**

Appendix A: Curriculum Vitae – Dr. John Ballato

Department of Energy

1. “Novel High Temperature and Radiation Resistant Infrared Glasses and Optical Fibers for Sensing in Advanced Small Modular Reactors” through the Nuclear Energy University Program 2013 – 2016; Award Total: **\$799,999**.

Department of Commerce

1. “Novel Polymeric Optical Fibers, Fiber Amplifiers, and Lasers” through the National Textile Center (NTC), 1-May-2001 to 30-Apr-2004; Award Total: **\$354,786**.

Small Business Association

1. “Innovation Center at the Clemson University Advanced Materials Center,” 30-Sep-2009 to 31-Dec-2010; Award Total: **\$100,000**.
2. “Innovation Center at the Clemson University Advanced Materials Center,” 1-Jan-2012 to 31-Dec-2013; Award Total: **\$100,000**.

Industrial Programs

1. “Fabrication of Fibers,” Physical Optics Corporation, 20-Jun-1998 to 19-Jun-1999; Award Total: **\$30,000**.
2. “Photonic Materials Research,” 3M Corporation, 1-Jul-1998 to 30-Jun-2003; Award Total: **\$35,000**.
3. “Modified Chemical Vapor Deposition System,” 3M Corporation, Equipment Gift, 1-Jul-2004; Award Total: **\$894,100**.
4. “Optical Fiber Glass,” 3M Corporation, Equipment Gift, 1-Jul-2007; Award Total: **\$171,441**.
5. “XeCl Excimer Laser,” TDK, Equipment Gift, 1-Jul-2002; Award Total: **\$20,000**.
6. “Fusion Splicer,” AFL Telecommunications, Equipment Gift, 5-Dec-2011; Award Total: **\$3,000**.
7. “Quantum Optical Sensing,” Northrop Grumman Corporation, 1-Jun-2008 to 30-Nov-2008; Award Total: **\$30,000**.
8. “Near Infrared Optical Fiber,” Northrop Grumman Corporation, 1-Jul-2008 to 30-Jun-2009; Award Total: **\$55,700**.
9. “Polycrystalline Electro-Optic Fiber,” Northrop Grumman Corporation through a DARPA Seedling grant, 4-Nov-2008 to 4-Sep-2009; Award Total: **\$49,983**.
10. “Semiconductor Optical Fiber,” Northrop Grumman Corporation, 1-Mar-2009 to 31-Dec-2009; Award Total: **\$25,000**.
11. “SBS Suppressing Optical Fiber,” Northrop Grumman Corporation, 1-Mar-2009 to 31-Dec-2009; Award Total: **\$25,000**.
12. “Semiconductor Optical Fiber,” Northrop Grumman Corporation, 12-Dec-2011 to 11-Jun-2012; Award Total: **\$107,000**.
13. “Novel Crystalline Semiconductor Optical Fibers,” Raytheon Corporation, 7-Dec-2010 to 30-Jun-2012; Award Total: **\$59,754**.
14. “Nanoparticle Research,” Corning Incorporated, 1-Dec-2011 to 30-Jun-2012; Award Total: **\$30,000**.
15. “Molten Core Fabrication of Crystalline Bismuth Germanate (Bi₄Ge₃O₁₂) Optical Fibers,” ABB Corporation, 2013 – 2015; Award Total: **\$196,023**.
16. “Electro-optic optical fibers,” Northrop Grumman Corporation, 1-Jul-2014 to 30-Jun-2015; Award Total: **\$50,000**.
17. “Specialty Optical Fiber,” AFL Telecommunications, Equipment Gift, 27-April-2015; Award Total: **\$27,426**.
18. “Erbium doped intrinsically low Brillouin gain optical fiber,” General Technical Services, Inc, 14-Aug-2015 to 30-Sept-2015; Award Total: **\$48,764**.

Appendix A: Curriculum Vitae – Dr. John Ballato

19. “Modified Chemical Vapor Deposition System,” Molex, Equipment Gift, 8-March-2019; Award Total: **\$898,000**.
20. “Optical Fibers for Advanced Solar Lasers,” Toyota Motor Company, 1-June-2020 to 31-March-2021, Award Total: **\$73,802**.
21. “Fiber Laser Materials Research,” Northrop Grumman Systems Corporation, 15-March-2022 to 30-December-2022 (Phase I), Award Total: **\$24,123**.
22. Proprietary Contract Research; Award Totals: **\$661,325**.

Other

1. “Photonic Bandgap Composites,” Oak Ridge Associated Universities, 1-May-1998 to 30-Apr-1999; Award Total: **\$5,000**.
2. “Educational and Research Preparation in Optical Fiber Technologies,” AdvanceSC, 2-May-2005 to 1-May-2007; Award Total: **\$75,000**.
3. “SC NSF CAREER Network,” SC EPSCoR, 1-Sep-2006 to 30-Apr-2007; Award Total: **\$5,000**.
4. “Center of Economic Excellence in Optical Materials,” South Carolina Commission on Higher Education, 27-Apr-2004; Award Total: **\$10,000,000**.

Co-Principal Investigator / Sub-Award Programs

Federal Programs

Department of Defense

1. “Electro Active Coatings and Shutters for Protection of Sensors” through DARPA, 16-Jan-1999 to 15-Dec-2000, Robert Schwartz, PI (Clemson University), Award Total: \$210,000, Ballato Share: **\$105,000**.
2. “Near-Field Microscopy of Polymer Based Nanocomposites” through AFOSR, 1-Apr-2000 to 31-Mar-2001, David Carroll, PI (Clemson University), Award Total: \$205,470, Ballato Share: **\$102,735**.
3. “Advanced Optical Fibers for High Power Lasers” through the US Air Force, 13-Sep-2010 to 12-Sep-2013, Liang Dong, PI (Clemson University), Award Total: \$275,000, Ballato Share: **\$82,500**.
4. “Polarization-Maintaining Large-core All-solid Photonic Bandgap Fibers for Power Scaling of High Power Fiber Lasers” through the Missile Defense Agency (MDA), 15-Mar-2011 to 14-Mar-2013, Liang Dong, PI (Clemson University), Award Total: \$592,197, Ballato Share: **\$177,659**.
5. “MEMS Sensors for Chemical and Biological Sensing” through the US Army, 15-Aug-2004 to 31-Jul-2006, Stephen Foulger, PI (Clemson University), Award Total: \$141,699, Ballato Share: **\$0**.
6. “Intrinsically-low Brillouin gain materials / optical fibers” Joint Technology Office High Energy Laser Multidisciplinary Research Initiative (JTO HEL MRI) through the US Army, 1-Apr-2012 to 31-Mar-2015, Pete Dragic, PI (University of Illinois – Urbana-Champaign), Award Total: \$630,222, Ballato Share: **\$334,018**.
7. “Internal Cooling of Fiber and Disc Lasers by Radiation Balancing and other Optical or Phonon Processes,” US Department of Defense Multidisciplinary University Research Initiative (MURI) through the US Air Force Office of Scientific Research, J. Gary Eden, PI (The University of Illinois – Urbana-Champaign), Award Total: \$7,566,358, Ballato Share: **\$1,152,500**.
8. “Virtual Manufacturing Lab (VM-Lab): A Multimedia Design House for Digital Learning in Manufacturing-USA Workforce Education” Office of Naval Research (ONR), 1-Oct-2019 to 30-Sep-2022, Lionel C. Kimmerling, PI (Massachusetts Institute of Technology), Ballato Share: **\$250,000**.
9. “Advanced Technologies for High Energy Laser Applications,” US Army Space and Missile Defense Command (SMDC), Richard Watkins, PI (Clemson University), Award Totals: Year 1 (30-Aug-2021 to 30-Dec-2022): \$4,991,570, Ballato share: **\$1,247,893**. Year 2 (28-Sept-2022 to 31-Sep-2023): \$5,387,500, Ballato share: **\$1,346,875**.

Appendix A: Curriculum Vitae – Dr. John Ballato

Department of Energy

1. “Low-cost Vacuum Insulated Glass (VIG) for Retrofit of Single Pane Windows,” Office of Energy Efficiency and Renewable Energy, Jungho Kim (PI, The University of Maryland), Ballato Share: **\$85,000**.

National Science Foundation

1. “Acquisition of a Fourier Transform Raman and Infrared Spectrometer for Materials Research and Education in South Carolina,” Apparao Rao (PI, Clemson University), 1-Sep-2002 to 31-Aug-2004, Award Total: \$173,500, Ballato Share: **\$0**.
2. “Collaborative Research Planning Grant: I/UCRC for the Ceramic, Composite, and Optical Materials Center” Dennis Smith (PI, Clemson University), 1-Aug-2009 to 31-Jul-2010, Award Total: \$10,000, Ballato Share: **\$2,500**.
3. “Collaborative Research Planning Grant: I/UCRC for the Ceramic, Composite, and Optical Materials Center” Phil Brown (PI, Clemson University), 15-Jul-2010 to 30-Jun-2015, Award Total: \$400,000, Ballato Share: **\$132,000**.
4. “REU Site: Interfaces and Surfaces: Exploring and Experiencing Science (I SEE Science),” Molly Kennedy (PI, Clemson University), 15-Mar-2011 to 28-Feb-14, Award Total: \$270,000, Ballato Share: **\$7,290**.
5. “Synthesis-Microstructure-Performance Relations in Oxide Ceramic Scintillators” Luiz Jacobsohn (PI, Clemson University), 15-Jun-2012 to 5/14/2016, Award Total: \$125,569, Ballato Share: **\$25,114**.
6. “REU Site: Research Experience for Undergraduates in Advanced Material Sciences,” Rachel Getman (PI, Clemson University), Award Total: \$319,668.

National Aeronautics and Space Administration

1. “Characterization of Stress and Geometry Effects on the Displacement and Load Bearing Performance of RAINBOW Ceramics” Robert Schwartz (PI, Clemson University), 1-Apr-1998 to 31-Mar-1999, Award Total: \$60,000, Ballato Share: 25% (**\$15,000**).
2. “Prediction of Aging and Fatigue Effects on the Performance of Thunder Actuators for Space System Applications” Robert Schwartz (PI, Clemson University), 1-Jan-2000 to 30-Apr-2001, Award Total: \$23,535, Ballato Share: 25% (**\$5,884**).
3. “Mechanically Robust Crystalline Colloidal Arrays (CCA) Encapsulated in Inorganic/Organic Hybrid Matrices of Tetraethylorthosilicate (TEOS) and Polyethylene Oxide (PEO)” Steve Foulger (PI, Clemson University), 1-Sep-2000 to 14-Jun-2002, Award Total: \$25,000, Ballato Share: 25% (**\$6,250**).

Department of Commerce

1. “Light Emitting Nanocomposite Fibers (LENFs)” through the National Textile Center (NTC), Phil Brown (PI, Clemson University), 1-May-2010 to 30-Apr-2012, Award Total: \$43,638, Ballato Share 50% (**\$21,819**).

Other

1. “Mechanochromic Materials Research and Development Services,” Department of the Treasury, Bureau of Engraving and Printing (BEP), Christine Cole (PI, Clemson University), Award Total: \$149,998, Ballato Share: **\$40,000**.

South Carolina Commission on Higher Education

1. “Mesoscopically Periodic Photonic Crystal Materials: Tunable Optical Switches” Steve Foulger (PI, Clemson University), 1-Jan-2000 to 31-Dec-2000, Award Total: \$98,156, Ballato Share: 30% (**\$29,447**).
2. “Efficient Emitters Based on the Incorporation of Photoluminescent Polymers with Tunable Photonic Bandgap Composites” Steve Foulger (PI, Clemson University), 1-Jan-2001 to 30-Jun-2002, Award Total: \$65,550, Ballato Share: 20% (**\$13,110**).

South Carolina Experimental Program to Stimulate Cooperative Research (EPSCoR)

1. “Prediction of Aging and Fatigue Effects on the Performance of Thunder Actuators” Robert Schwartz (PI, Clemson University), 21-Feb-2000 to 30-Jun-2000, Award Total: \$10,280, Ballato Share: 25% (**\$2,570**).

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2. “Mechanically Robust Crystalline Colloidal Arrays (CCA) Encapsulated in Inorganic/Organic Hybrid Matrices of Tetraethylorthosilicate (TEOS) and Polyethylene Oxide (PEO)” Steve Foulger (PI, Clemson University), 30-Jun-2000 to 31-Jul-2001, Award Total: \$11,423, Ballato Share 25% (\$2,856).

SECTION III – PUBLICATIONS

[Google Scholar](#): Citations: 13,400+, h-index: 55, i₁₀-index: 242

Books

1. J. Ballato and M. Gupta, Eds., [Handbook of Photonics](#), 2nd Edition, CRC Press, ISBN 0849330955 (2006).
2. S. Pyshkin and J. Ballato, [“Optoelectronics - Advanced Materials and Devices,”](#) InTech, New York, ISBN 978-953-51-0922-8 (2013).
3. S. Pyshkin and J. Ballato, [“Optoelectronics - Materials and Devices,”](#) InTech, New York, ISBN 978-953-51-2174-9 (2015).
4. L. B. Shaw and J. Ballato, [“Fiber Lasers XII: Technology, Systems, and Applications,”](#) Proceedings of the SPIE, Volume 9344, ISBN 978-162-84-1434-9 (2015).
5. J. Ballato, [“Fiber Lasers XIII: Technology, Systems, and Applications,”](#) Proceedings of the SPIE, Volume 9728, ISBN 978-162-84-1963-4 (2016).
6. S. Pyshkin and J. Ballato, [“Optoelectronics - Advanced Device Structures,”](#) InTech, New York, ISBN 978-953-51-3370-4 (2017).
7. J. Ballato and L. Dong, [“Proceedings of the Sixth International Workshop on Specialty Optical Fibers and Their Applications](#) (WSOF 2019); Volume 1120601 (2019).

Technical Standards

1. A. Meitzler, S. Trolier-McKinstry, J. Ballato, J. Fousek, A. Bhalla, R. Guo, P. Bloomfield, R. Newnham, W. Cao, S. Pilgrim, L. E. Cross, C. Randall, J. Dougherty, and Q. Zhang, *IEEE Standard Definitions and Terms Associated with Ferroelectric and Related Materials* (2005).

Book Chapters

1. R. Schwartz, J. Ballato, and G. Haertling, “Piezoelectric and Electro-Optic Ceramics” Chapter 4 in *Ceramic Materials for Electronics*, R. Buchanan, ed., Marcel-Dekkar, Inc, New York, pp. 207 - 322 (2004).
2. J. DiMaio and J. Ballato “Ceramic Photonic Crystals: Materials, Synthesis, and Applications” in *Chemical Processing of Ceramics*, B. Lee and S. Komarneni, ed., Marcel-Dekkar, Inc, New York, pp. 543 – 569 (2005).
3. P. Brown, B. Kokuoz, B. Ellerbrock, K. Stevens, and J. Ballato, “Novel Approaches to Complex Optical Fibers,” Chapter 1, pp. 1 – 15, in *Trends in Photonics*, J. Canning, Ed (2010); ISBN: 978-81-7895-441-7.
4. S. Pyshkin and J. Ballato, “Long-Term Convergence of Bulk- and Nano-Crystal Properties,” Chapter 19 (pp. 459 – 476) in *Optoelectronics: Materials and Techniques*, InTech, New York, ISBN: 978-953-307-276-0.
5. S. Pyshkin and J. Ballato, “Advanced Light Emissive Device Structures,” (Chapter 1, pp. 1 – 24) in *Optoelectronics - Advanced Materials and Devices*, InTech, New York, S. Pyshkin and J. Ballato, editors (2013). ISBN 978-953-51-0922-8.
6. S. Pyshkin, J. Ballato, S. Belevschii, E. Rusu, A. Racu, and D. Van DerVeer, “Synthesis, characterization and sampling of GaP nanoparticles for light emissive devices,” pp. 327 – 330 in Chapter 3: Nanoparticle Synthesis & Applications, *Nanotechnology 2010: Advanced Materials, CNTs, Particles, Films and Composites*, The Nano Science and Technology Institute (NSTI), Cambridge, MA (2016). ISBN 978-1-4398-3401-5.
7. S. Pyshkin, J. Ballato, I. Luzinov, and B. Zdyrko, “Fabrication and Characterization of the GaP/PGMA Polymer Nanocomposite for Advanced Light Emissive Device Structures,” pp. 772 – 775 in Chapter 5:

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Composite Materials, *Nanotechnology 2010: Advanced Materials, CNTs, Particles, Films and Composites*, The Nano Science and Technology Institute (NSTI), Cambridge, MA (2016). ISBN 978-1-4398-3401-5.

8. J. Ballato, "Let there be light... Why study (optical) materials," in *Materials Engineering for the Curious: Why study Materials Engineering*, The Curious Academic Publishing; First edition (2016); ASIN: B01BPVX0AO.
9. S. Pyshkin and J. Ballato, "[Properties of GaP studied over 50 years](#)," in *Optoelectronics - Advanced Device Structures*, InTech, New York, 2017; ISBN 978-953-51-3370-4.
10. P. Dragic and J. Ballato, "[Materials Development for Advanced Optical Fiber Sensors and Lasers](#)," in the *Handbook of Optical Fiber*, G.-D. Peng, editor, Springer Nature Singapore Pte Ltd. 2019; 10.1007/978-981-10-7087-7.
11. J. Ballato, "[Optical fiber](#)," Chapter 6.4, pp.705 – 719, in the *Encyclopedia of Glass Science, Technology, History and Culture*, P. Richet, editor, John Wiley & Sons, Hoboken, NJ, 2021; ISBN 978-111-87-9942-0.
12. S. Tanabe, J. Ballato, and G. Righini, Chapter 5, pp. 75 – 92, "Glass in Information and Communication Technologies (ICT) and Photonics," [International Year of Glass 2022: Welcome to the Glass Age](#), International Commission on Glass (2022); published in English and translated into Spanish.
13. L. Petit, J. Ballato, and W. Blanc, "Engineering optical properties with nanoparticles in glass and optical fiber," in *Glass Photonics: Materials, Properties, and Applications*, M. Ferrari, ed. Jenny Stanford Publishing (formerly Pan Stanford Publishing), 2022.
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3. A. Ballato and J. Ballato, "Accurate electrical measurements of modern ferroelectrics," *Ferroelectrics* **182**, 29 – 59 (1996).
4. J. Ballato, M. Dejneka, E. Snitzer, R. E. Riman, and W. Zhou, "Sol-gel synthesis of rare-earth-doped fluoride glass thin films," *Journal of Materials Research* **11**, 841 – 849 (1996).
5. A. Ballato and J. Ballato, "High-frequency piezoceramic equivalent circuit," *Journal of the American Ceramic Society* **79**, 1413 – 1415 (1996).
6. J. Ballato, M. Agarwala, R. van Weeren, R. E. Riman, and S. C. Danforth, "Patterning for planar waveguides," *Electronics Letters* **33**, 83 – 84 (1997).
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8. I-C. Lin, A. Navrotsky, J. Ballato, and R. E. Riman, "High-temperature calorimetric study of glass-forming fluorozirconates," *Journal of Non-Crystalline Solids* **215**, 113 – 124 (1997).
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16. J. Ballato, "Tailorable visible photonic bandgaps through microstructural order and coupled material effects in SiO_2 colloidal crystals," *Journal of the Optical Society of America B* **17**, 219 – 225 (2000).
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26. J. Ballato, J. DiMaio, E. Gulliver, D. Carroll, D-G. Han, and R. Riman, "A simple *a priori* determination of optical transmission gaps in photonic crystals of weak symmetry," *Optical Materials* **20**, 51 – 55 (2002).
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SECTION IV – PATENTS AND PATENTS PENDING

Issued Patents

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SECTION V – PRESENTATIONS

Plenaries, Keynotes, Tutorials, Award Lectures, and Global Webinars

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11. J. Ballato, “Energy and the Economy,” IEEE Power System Conference (PSC 2015), Clemson, SC, March 2015; **Conference Keynote**.
12. J. Ballato, “New models for driving regional competitiveness and job growth,” Southern Textile Research Conference, Greenville, SC, May 2015; **Keynote**.
13. J. Ballato, “The Molten Core Fabrication of Novel Optical and Optoelectronic Fibers,” University of Torino, Torino (Turin), Italy, June 2017; **Plenary to University of Torino optics conference as an OSA Traveling Lecturer**.
14. J. Ballato, M. Cavillon, P. Dragic, C. Kucera, and T. Hawkins, “A Unified Materials Approach to Mitigating Optical Nonlinearities in Fiber Lasers,” SPIE Photonics Europe 2018, Strasbourg, France, April 2018; **Keynote**.
15. M. Cavillon, C. Kucera, T. Hawkins, P. Dragic, and J. Ballato, “Fabrication of Intrinsically Low Nonlinearity Glass Optical Fibers,” Annual Meeting of the Glass and Optical Materials Division of the American Ceramic Society, San Antonio, TX, May 2018. **Norbert J. Kreidl Award Lecture**.
16. J. Ballato, “Novel material approaches to advanced optical fibers and fiber lasers,” 2018 IEEE Photonics Conference, 31st Annual Conference of the IEEE Photonics Society, Reston, VA, October 2018; **Tutorial**.
17. J. Ballato, “Materials development for advanced optical fibers,” OASIS 7 (Optical Engineering and Science in Israel) of ILEOS (The Israel Lasers and Electro-Optics Society), Tel Aviv, Israel, April 2019; **Keynote**.
18. U. J. Gibson, S. Song, F. Laurell, J. Ballato, and M. Fokine, “Semiconductor-core optical fibers,” Optics and Photonics Congress 2019, Busan, Korea, July 2019; **Plenary**.
19. J. Ballato, “Novel Materials for Advanced Optical Fibers,” The Optical Society (OSA) **global webinar**, hosted by the *Fiber Modeling and Fabrication Technical Group*, 24 April 2020.
20. J. Ballato, P. Schultz, H. Ebendorff-Heidepriem, and U. J. Gibson “Frontiers of Optical Fibers,” joint Materials Research Society (MRS) / American Ceramic Society (ACerS) **global webinar**, 5 August 2020.
21. J. Ballato, “Materials for Advanced Optical and Optoelectronic Fibers,” Virginia Polytechnic Institute and State University (Virginia Tech), [Virtual due to COVID-19], October 2020; **OSA Traveling Lecturer**.
22. J. Ballato, “Fascinating materials science for advanced optical fibers,” International Conference on Lasers, Optics, Photonics & Sensors [Virtual due to COVID-19], June 2021; **Keynote**.
23. J. Ballato, “The Future of Fiber Optic Materials: A Tutorial,” 26th Optoelectronics and Communications Conference (OECC) 2021, Hong Kong, SAR [hybrid due to COVID-19], July 2021; **Plenary Tutorial**.
24. J. Ballato, “Optical Fiber meets the Periodic Table: The past, present, and future of the molten core method,” **George W. Morey Award Lecture**, Glass and Optical Materials Division of the American Ceramic Society Annual Meeting, Baltimore, MD, May 2022.

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25. J. Ballato, "Fiber optics light up our life: Glass, fiber, light, and the applications of optical fiber," **Boeing Distinguished and Scholar Seminar Series** (virtual), September 2022.
26. J. Ballato, "Semiconductor optical fiber: on-chip optoelectronics in fiber form," **William Streifer Scientific Achievement Award Lecture**, IEEE Photonics Conference (IPC), Vancouver, Canada, November 2022.
27. J. Ballato, "Molten Core Fiber Fabrication: Opening up the Periodic Table," 7th International Workshop on Specialty Optical Fibers and their Applications, Adelaide, Australia, December 2022; **Keynote**.
28. J. Ballato, T. W. Hawkins, P. D. Dragic, M. Engholm, M. J. F. Digonnet, and L. Dong, "Stay Cool: Material approaches to thermal management in advanced fiber lasers and amplifiers," SPIE Photonics West, Photonic Heat Engines: Science and Applications V (Conference OE504), San Francisco, CA, February 2023; **Keynote**.

Invited Lectures, Seminars, Colloquia, and Presentations

1. R. E. Riman, M. Dejneka, J. Ballato, and E. Snitzer, "Sol-Gel Synthesis of Halide Glasses for Passive and Active Optics," SPIE Sol-Gel III Conference, San Diego, CA, July 1994.
2. R. E. Riman, J. Ballato, M. Dejneka, and E. Snitzer, "Sol-Gel Synthesis of Fluoride Glasses," American Ceramic Society Annual Meeting, Indianapolis, IN, April 1996.
3. J. Ballato "Chemically-Derived Luminescent Materials for Telecommunication Applications," Clemson University Department of Chemistry, September 1998.
4. J. Ballato, "New Materials and Devices for Photonic Communications," Clemson University Department of Physics, Clemson, SC, October 1998.
5. J. Ballato, "New Materials and Structures for Photonic Communications and Display Technologies," University of Cincinnati, Cincinnati, OH, November 1998.
6. A. James and J. Ballato, "Novel Photonic Applications of Sol-Gel-Derived Silica," American Ceramic Society, Southeast Sectional Meeting, Nashville, TN, November 1998.
7. J. Ballato, "Ceramics for Optical Temperature Measurements," American Ceramic Society, Southeastern Sectional Meeting, Pinehurst, NC, March 1999.
8. J. Ballato, "Rare Earth Doped Ferroelectrics for Novel Tunable Photonic Devices," US Army Research Office Workshop on New Concepts on 3-D Optical Devices Using Rare Earths and Other Novel Approaches, Asilomar, CA, April 1998.
9. J. Ballato, "New Hosts, Synthesis Methods, and Applications of Rare-Earth-Doped Materials for Next-Generation Optical Fiber Telecommunication Systems," 3M Corporation, St. Paul, MN, May 1998.
10. J. Ballato, "New Materials and Structures for Next-Generation Photonic Communications," TRW Corporation, Redondo Beach, CA, November 1998.
11. J. Ballato, "Order/Disorder Effects on the Optical Properties and Applications of Photonic Bandgap Structures," Emory University, Atlanta, GA, April 1999.
12. J. Ballato, "Novel Approaches to Tunable Optical Properties in Photonic Materials and Structures," Rutgers University, Piscataway, NJ, May 1999.
13. J. Ballato, "Future Trends in Telecommunication Components" Alcoa-Fujikura Limited, Spartanburg, SC, February 2000.
14. J. Ballato, "Novel Materials and Structures for Next Generation Active and Passive Photonics," 3M Corporation, St. Paul, MN, March 2000.
15. P. Iyer, R. Czerw, H. Shah, D. Carroll, J. Ballato, and D. Smith, "Optical Properties of Fluoropolymer Nanotube Composites," SPIE/OSA Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging, Charlotte, NC, September 2000.
16. H. Shah, E. Nelson, J. Ballato, S. Foulger, and D. Smith, "Recent Progress in Perfluorocyclobutane Polymer Technology" Fluoropolymer 2000 (American Chemical Society), Savannah, GA, October 2000.

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17. H. Shah, E. Nelson, J. Ballato, C. Langhoff, and D. Smith, "Random Perfluorocyclobutyl Copolymers with Controlled Optical Properties" Fluoropolymer 2000 (American Chemical Society), Savannah, GA, October 2000.
18. J. Ballato, "Following the Green Brick Road: A Ceramist's Thoughts on Financial Planning," Student Forum, American Ceramic Society Annual Meeting, St. Louis, MO, April 2000.
19. J. Ballato, "Novel Approaches to Performance-Enhanced Photonic Materials and Structures," The University of California – Los Angeles, Los Angeles, CA, June 2000.
20. J. Ballato, "Ceramic Materials Processing and Applications," Milliken & Company, Spartanburg, SC, September 2000.
21. J. Kolis, H. Giesber, J. Ballato, and W. Pennington, "Hydrothermal Growth of Lanthanide Orthoborate Crystals for Deep UV Nonlinear Optical Applications," SPIE/OSA Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging, Charlotte, NC, September 2000.
22. J. Ballato, "The Past, Present, and Future of Materials in Optical Fiber Communications," American Ceramic Society Southeastern Sectional Meeting, Pinehurst, NC, March 2001.
23. J. Ballato, "Novel Organic and Inorganic Composite Photonic Materials and Structures," 3M Corporation, St. Paul, MN, May 2001.
24. J. Ballato, "Nanophotonics – Applying Nanomaterials to Photonic Technologies," Chesapeake Conference (E.I. du Pont de Nemours and Company), Wilmington, DE, July 2001.
25. J. Ballato, "Nano-Photonics," 2nd International School on Quantum Devices and Nanostructures, Erice, Trapani, Italy, July 2001.
26. D. Smith, M. Kumar, E. Nelson, J. Ballato, S. Chen, and S. Foulger, "Property Tailored Perfluorocyclobutyl (PFCB) Polymers for Optical Devices," SPIE Annual Meeting, San Diego, CA, July 2001.
27. J. Ballato, "Antimicrobial Ceramic Thin Film," Milliken & Company, Spartanburg, SC, August 2001.
28. J. Ballato, "Opportunities in Nanotechnology," Fall Meeting, American Association of Textiles Chemists and Colorists, Simpsonville, SC, September 2001.
29. D. Smith, S. Kumar, S. Chen, J. Jin, J. Ballato, and S. Foulger, "Low Loss and Highly Processable Fluoropolymers for Optical Waveguiding," Optical Society of America Annual Meeting, Long Beach, CA, October 2001.
30. S. Foulger, A. Lattam, P. Yiang, Y. Ying, J. Ballato, and D. Smith, "Photonic Bandgap Composites," OSA Optics in the Southeast Conference, Clemson, SC, October 2001.
31. D. Smith, S. Kumar, S. Chen, J. Ballato, J. Jin, C. Ligon, and S. Foulger, "Highly Processable Perfluorocyclobutyl (PFCB) Copolymer Solutions and Thermosets for Optical Applications" OSA Optics in the Southeast Conference, Clemson, SC, October 2001.
32. D. Smith, S. Kumar, S. Chen, J. Jin, C. Ligon, J. Ballato, and S. Foulger, "Highly Processable and Property Tunable Perfluorocyclobutyl (PFCB) Copolymers for Low Loss Optical Waveguiding" Materials Research Society Fall Meeting, Boston, MA, October 2001.
33. J. Ballato, "Novel Multifunctional Photonic Materials and Composites," Rutgers University, Piscataway, NJ, November 2001.
34. D. Carroll and J. Ballato, "Organic Matrix Nanocomposites for Light Emitting Diode Applications," SPIE Microelectronics and MEMs Conference, Adelaide, Australia, December 2001.
35. J. Ballato, "The Chemistry and Physics of Optical Polymers for Telecommunication Applications," American Chemical Society Meeting, Western Carolinas Section, Greenville, SC, January 2002.
36. J. Ballato, S. Foulger, and D. Smith, "Optical Materials Research at the Clemson University Center for Optical Materials Science and Engineering Technologies," Swiss Federal Institute of Technology (ETH), Zürich, Switzerland, April 2002.

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37. H. Giesber, J. Ballato, W. Pennington, and J. Kolis, "Hydrothermal Synthesis and Optical Properties of Active and Nonlinear Borate Single Crystals," American Ceramic Society Annual Meeting, St. Louis, MO, April 2002.
 38. H. Giesber, J. Ballato, W. Pennington, and J. Kolis, "Optical and Crystallographic Properties of Hydrothermally Grown Single Crystal Borates," 4th International Conference on Borate Glasses, Crystals, and Melts, Cedar Rapids, IA, July 2002.
 39. J. Ballato, "Advanced Photonic Materials," Kyoto University, Kyoto, Japan, October 2002.
- Traveling Lecturer for United States Advisory Committee to the International Commission on Optics: Invited lectures given in Kishinev, Moldova (November 2002).***
40. Seminar of the Center for Materials Science, "Inorganic Single Crystals for Nonlinear and Active Optical Elements."
 41. Free International University of Moldova (ULIM): "Tunable Photonic Crystals."
 42. Faculty of microelectronics & informatics, State Technical University of Moldova, "Fundamentals of Optical Communications: Materials, Components, and Systems."
 43. Republican physical seminar, "Fundamentals of Optical Communications: Materials, Components, and Systems."
 44. Institute of Applied Physics, Center for Optoelectronics, "Fundamentals of Optical Communications: Materials, Components, and Systems," and "Fluoropolymers for Low Loss Optical Components."
 45. Faculty of Physics of the State Technical University of Moldova, "Fundamentals of Optical Communications: Materials, Components, and Systems."
 46. Institute of Applied Physics, Lises, "Nanophotonics: Unique Optical Physics in Nanoscale Materials."
 47. J. Ballato, "The Unique Role of Metals in Future Optical Fiber Communication Systems," Greenville Chapter of the American Society of Metals, Greenville, SC, November 2002.
 48. J. Ballato, S. Foulger, and D. Carroll, "Novel Light Emission, Detection, and Sensing Devices Based on Optical Nanocomposites," SPIE Photonics West Conference, San Jose, CA, January 2003.
 49. D. Smith, S. Suresh, S. Chen, C. Topping, and J. Ballato, "Novel Perfluorocyclobutyl (PFCB) polymers containing Isophorone Derived Chromophores for Electro-Optic Applications," SPIE Photonics West Conference, San Jose, CA, January 2003.
 50. D. Smith, S. Foulger, S. Chen, C. Topping, and J. Ballato, "Perfluorocyclobutyl Copolymers for Low Loss Electro-Optics" SPIE Photonics West, San Jose, CA, January 2003.
 51. J. Ballato, "The Present and Future of Materials for Optical Communications," Nano Week at Furman University, Greenville, SC, July 2003.
 52. D. Carroll, S. Webster, R. Czerw, and J. Ballato "Nonlinear Intensity Transmission in Carbon Nanotube Suspensions and Their Doped Variants," SPIE Annual Meeting, San Diego, CA August 2003.
 53. J. Ballato, D. Smith, and S. Foulger, "Optical Properties of Perfluorocyclobutyl (PFCB) Polymers," SPIE Annual Meeting, San Diego, CA August 2003.
 54. S. Foulger and J. Ballato "Highly Tunable Photonic Crystal Structures," American Vacuum Society Annual Meeting, Baltimore, MD, November 2003.
 55. D. Smith, S. Sursh, S. Chen, J. Ballato, and C. Topping, "Perfluorocyclobutyl Polymers for Integrated Photonics" *Organic Thin Films for Photonics Symposium*, Optical Society of America Annual Meeting, Tuscon, AZ 2003.
 56. D. Smith, P. Perera, N. Abayasinghe, S. Suresh, and J. Ballato, "Synthesis and In Situ Characterization of Polyarylenes, Fluoropolymers, and Novel Lactide Derived Materials" *Polymers in Advanced Technology*, American Chemical Society Division of Polymer Chemistry Symposium, Ft. Lauderdale, FL 2003.

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57. J. Ballato, "Nanotechnology Innovation," *Identifying Applications & Overcoming Barriers for the Manufacturing of Nanomaterials*, South Carolina Research Authority meeting, Clemson, SC September 2003.
58. J. Ballato, D. Smith, and S. Foulger, "Experimental and Theoretical Optical Properties of Perfluorocyclobutyl (PFCB) Polymers," OSA Optics in the Southeast, Orlando, FL, November 2003.
59. J. Ballato, L. Lu R. Riman, C-W. Chen and G. A. Kumar, "Unique Rare Earth Doped Nanocomposites for Photonic Applications," American Ceramic Society Annual Meeting, Indianapolis, IN, April 2004.
60. J. Ballato and A. Ballato, "Materials for Freezing Light," DARPA Workshop on Slow Light, University of North Carolina at Charlotte, Charlotte, NC, July 2004.
61. J. Ballato, "The Center for Optical Materials and Engineering Technologies at Clemson University – A South Carolina Research Center of Economic Excellence," OSA Optics in the Southeast, Charlotte, NC, November 2004.
62. J. DiMaio and J. Ballato, "Highly Tunable Plasmonic Films for Designer Spectral Characteristics," OSA Optics in the Southeast, Charlotte, NC, November 2004.
63. J. Ballato and J. DiMaio, "Effects of Symmetry and Defects on the Extraordinary Transmission of Light through Plasmonic Films," Diffractive Optics & Micro-Optics Meeting, Optical Society of America Annual Meeting, Rochester, NY, October 2004.
64. J. Ballato, J. DiMaio, L. Lu, R. Riman, C-W. Chen and G. Kumar, and D. Smith, "Rare Earth Doped Nanocomposites for Photonic Applications," *Synthesis and Characterization of Nanomaterials for Advanced Microelectronic or Photonic Applications Symposium*, 79th American Chemical Society Symposium, Clarkson University, Potsdam, NY, June 2005.
65. J. Ballato and A. Ballato, "Optoelectronic Materials for Freezing Light," American Ceramic Society PAC RIM Conference, Maui HI, September 2005.
66. J. Ballato, J. DiMaio, R. Riman, C-W. Chen and G. Kumar, and D. Smith, "Unique Optical Performance from Rare Earth Doped Low Phonon Energy Nanoparticles in Fluoropolymer Composites," American Ceramic Society PAC RIM Conference, Maui HI, September 2005.
67. J. Zavada and J. Ballato, "High Power Fiber Lasers," The Nonlinear Optics Workshop, Tucson AZ, October 2005.
68. J. Ballato and D. Smith, "The Optical Performance of Perfluorocyclobutyl-based Fluoropolymers and Waveguides," *Optoelectronic Integrated Circuits X Symposia*, SPIE Photonics West, San Jose CA, January 2006.
69. J. Ballato, "Advances in Optical Materials," Rutgers University, March 2006.
70. J. Ballato, "High Power Fiber Lasers," Northrop Grumman Space Technologies, Redondo Beach, CA, March 2006.
71. R. Riman, S. Bennison, and J. Ballato, "Transparent Multifunctional Armor (TMA) Materials," American Ceramic Society, Glass and Optical Materials Division Meeting, Greenville, SC, May 2006.
72. D. Smith, A. Neilson, S. Budy, J. Jin, S. Iacono, S. Ligon, and J. Ballato, "Fluorinated Polymers for Photonics. A Tutorial," *Organic Thin Films for Photonic Applications*, American Chemical Society National Meeting, San Francisco, CA, September 2006.
73. J. Ballato, "Fundamentals of Optical Materials: Application Specific Promises and Pitfalls," Fluoropolymer 2006, Charleston, SC, October 2006.
74. R. Riman, G. Kumar, C.-W. Chen, J. Brennan, J. DiMaio, J. Ballato, "Rare Earth-Based Nanocomposites for Photonic Applications," Materials Science & Technology 2006, Cincinnati, OH, October 2006.
75. S. Pyshkin, J. Ballato and G. Chumanov, "Optical Characterization of Long Term Ordered and Nanocrystalline GaP," 3rd International Conference on Materials Science and Condensed Matter Physics, Kishinev, Moldova, October 2006.

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76. J. DiMaio, J. Ballato, and R. Riman, "Novel Ultra-Broadband Amplifier Materials Based on Active Nanoparticles" SPIE Optics East, Boston, MA, October 2006.
77. J. DiMaio, B. Kokuoz, and J. Ballato, "UV Excited White Light Based on Nanoparticles with Complex Core-Shell Architecture," Southeastern Regional Meeting of the American Chemical Society (SERMACS), Savannah, GA, November 2006.
78. J. Ballato, J. DiMaio, B. Kokuoz, and T. James, "The Optical Properties of Novel Core-Shell Nanoparticles doped with Rare Earth Ions," 5th Asian Meeting on Electroceramics (AMEC-5), Bangkok, Thailand, December 2006.
79. J. Ballato, "Unique Optical Performance from Rare Earth Doped Nanoparticles in Polymer Composites," Rensselaer Polytechnic Institute (RPI), January 2007.
80. R. Riman, G. Kumar, V. Atakan, J. Brennan and J. Ballato, "Engineered Solution Synthesis of Rare Earth Doped Nanomaterials and Their Optical Properties," Optics and Photonics 2007: Penetrating Radiation Systems and Applications VIII, San Diego, CA, August 2007.
81. S. Pyshkin, J. Ballato, and G. Chumanov, "Optical Characterization of Long-Term Ordered and Nanocrystalline GaP," 3rd Int. MSCMP Conference, Kishinev, Moldova, October 2006
82. C. McMillen, J. Kolis, and J. Ballato, "Growth and Properties of Doped Scandia Crystals," IEEE LEOS, Lake Buena Vista, FL, October 2007.
83. V. Sudesh, T. McComb, Y. Chen, M. Bass, M. Richardson, J. Ballato, and A. Siegman, "Single Mode Lasing in a 200 μ m Diameter Core Gain-guided Index Anti-guided Diode End Pumped Fiber," IEEE LEOS, Lake Buena Vista, FL, October 2007.
84. J. Ballato, "Fundamentals of Optical Materials: Application Specific Promises and Pitfalls," Southeast Regional Meeting of the American Chemical Society (SERMACs), Greenville, SC, October 2007.
85. J. Ballato, C. McMillan, B. Kokuoz, and J. Kolis, "The Synthesis and Properties of Rare Earth Doped Yttria and Scandia for Eye-Safe Single Crystal and Ceramic Lasers," SPIE Photonics West, San Jose, CA, January 2008.
86. S. Pyshkin, J. Ballato, M. Bass and G. Turri, "New Phenomena in Luminescence of Gallium Phosphide," TMS 2008 Annual Meeting & Exhibition, New Orleans, LA, March 2008.
87. J. Kolis, C. McMillen, B. Kokuoz, B. Kokuoz, K. Serivalsatit, E. McCormick, P. Foy, T. Hawkins, and J. Ballato "Synthesis and Properties of Novel Eye-Safe and Mid-IR Single Crystal, Ceramic, and Optical Fiber Sources," SPIE Defense and Security, *Laser Source Technology for Defense and Security IV* Conference, Orlando, FL, March 2008.
88. J. Ballato, "Novel Light Emissive and Diffractive Fibers," *Advances in Colorants, Chemicals, Finishes, and Fibrous Materials*, Greenville, SC, June 2008.
89. J. Ballato, J. Kolis, C. McMillen, B. Kokuoz, B. Kokuoz, K. Serivalsatit, E. McCormick, P. Foy and T. Hawkins, "Synthesis and Properties of Eye-Safe Single Crystal, Ceramic, and Optical Fiber Sources," *21st Annual Solid State and Diode Laser Technology Review*, Directed Energy Professional Society (DEPS), Albuquerque, NM, June 2008.
90. J. Ballato, B. Kokuoz, J. DiMaio, and T. James, "Novel Light Emitting Nanoparticles and Nanocomposites," International Conference on Optical, Optoelectronic and Photonic Materials and Applications (ICOOPMA08), Edmonton, Canada, July 2008.
91. J. Ballato, "Novel Crystalline Core Optical Fiber," Northrop Grumman Space Technology Research Laboratories (STRL) Seminar Series, Redondo Beach, CA, March (2009)
92. J. Ballato, "Crystal Core Optical Fiber," The University of California – Los Angeles (UCLA), Los Angeles, CA, March 2009.
93. J. Ballato, P. Foy, T. Hawkins, B. Kokuoz, and A. James, "Novel Crystalline Core Optical Fibers," Optical Fiber Communication Conference and Exposition (OFC) and The National Fiber Optic Engineers Conference (NFOEC), San Diego, CA, March 2009.

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94. J. Ballato, "The Synthesis, Properties, and Applications of Novel Crystalline and Polycrystalline Optical Fibers," XII Conference on the Physics of Non-Crystalline Solids & Crystallization 2009, Foz do Iguaçu, Brazil, September 2009.
95. J. Kolis, C. McMillen, and J. Ballato, "Hydrothermal Growth of Single Crystals of Refractory Lanthanide Oxides," American Conference on Crystal Growth and Epitaxy (ACCGE-17), Lake Geneva, WI, August 2009.
96. D. Smith, S. Iacono, S. Budy, A. Neilson, R. Smith, J. Ballato, J. Park, N. Tomar, D. Brown, K. Tackett, and R. Verma, "Perfluorocyclobutyl (PFCB) Aryl Ether Polymer Based Copolymers and Composites," 19th International Symposium on Fluorine Chemistry, Jackson Hole, WY, August 2009.
97. J. Ballato, "Crystalline Semiconductor Core Optical Fibers," Crystal Fibre Inc., Birkerød, Denmark, September 2009.
98. J. Ballato, "Crystalline Semiconductor Core Optical Fibers," OFS, Brøndby, Denmark, September 2009.
99. J. Ballato, "Crystalline Semiconductor Core Optical Fibers," Danish Technical University, Copenhagen, Denmark, September 2009.
100. J. Ballato, "The Future of Specialty Optical Fibers: Old Designs, New Materials" **Invited Speaker and Panelist** for the *Workshop on Challenges and Opportunities in Fiber-based Devices and Applications* at the Asia Communications and Photonics Conference and Exhibition, Shanghai, China, November 2009.
101. J. Ballato, T. Hawkins, P. Foy, C. McMillen, B. Y. Kokuoz, H. K. Yan, R. Rice, B. Jalali and R. Stolen, "Progress in Semiconductor Optical Fibers," Asia Communications and Photonics Conference and Exhibition, Shanghai, China, November 2009.
102. J. Ballato, "Crystalline Semiconductor Optical Fibers," Shanghai Institute of Optics and Fine Mechanics, Shanghai, China, November 2009.
103. J. Ballato, T. Hawkins, P. Foy, C. McMillen, B. Y. Kokuoz, R. Rice, and R. Stolen, "Progress in Crystalline Semiconductor Core Optical Fibers," SPIE Photonics West, January 2010.
104. R. Singh, N. Gupta, J. Sadie, K. Poole, J. Ballato and S. Hu, "Challenges and Opportunities of Manufacturing Next Generation of Integrated Photonics," SPIE Photonics West, January 2010.
105. J. Ballato, "Novel Crystalline Semiconductor Core Optical Fibers," Western Carolina University, Cullowhee, NC, February 2010.
106. J. Ballato, "Crystalline Semiconductor Core Optical Fibers," M. G. McLaren Lecture Symposium, Rutgers University, Piscataway, NJ, April 2010.
107. J. Ballato, T. Hawkins, P. Foy, C. McMillen, B. Yazgan-Kokuoz, R. Stolen, and R. Rice, "Novel Crystal-Derived Optical Fibers," 18th International Conference on Advanced Laser Technologies (ALT'10), Egmond aan Zee, the Netherlands, September 2010.
108. J. Ballato, "Semiconductor Optical Fiber," Workshop on Specialty Optical Fibers and their Applications, Oaxaca, Mexico, October 2010.
109. J. Ballato, T. Hawkins, P. Foy, C. McMillen, R. Rice, and R. Stolen, "Semiconductor Core Optical Fibers," OSA Frontiers in Optics 2010, Rochester, NY, October 2010.
110. J. Ballato and K. Serivalsatit, "Fabrication of Sub-Micrometer-Grain Size Transparent Sesquioxide Ceramics," 3rd International Congress on Ceramics (ICC3), Osaka, Japan, November 2010.
111. J. Ballato, "Advances in Transparent Ceramics," University of Kyoto, Kyoto, Japan, November 2010.
112. J. Ballato, "Advances in Transparent Ceramics and Crystalline Optical Fibers," Stanford University, Department of Applied Physics Colloquium, Optics and Electronics Seminar Series (AP 483), January 2011.
113. J. Ballato, T. Hawkins, P. Foy, C. McMillen, S. Morris, R. Stolen, and R. Rice, "Advancements in Semiconductor Core Optical Fiber," IEEE Photonics Society Winter Topical 2011 (WIN 2011) Meeting on *Specialty Optical Fibers and Their Applications*, Keystone, CO, January 2011.

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114. R. Singh, N. Gupta, T. Hawkins, P. Foy, C. McMillen, S. Morris, R. Rice, K. Poole, and J. Ballato, "Role of Rapid Photothermal Processing in Providing Homogenous Nanostructure of Silica Clad Silicon Fibers," 2011 TMS Annual Meeting & Exhibition, San Diego, CA, February 2011.
115. J. Ballato, "The Future of Specialty Optical Fibers: Old Designs, New Materials," 2011 International Conference for Textiles Chemists and Colorists, Charleston, SC, March 2011.
116. J. Ballato, S. Morris, T. Hawkins, P. Foy, C. McMillen, R. Stolen, J. Fan, L. Zhu, and R. Rice, "Semiconductor Core Optical Fiber," OSA/IEEE Conference on Lasers and Electro-Optics (CLEO), Baltimore, MD, May 2011.
117. J. Ballato, "Faraday Rotation: Promising approaches to all-fiber, high power handling, devices for fiber lasers," US Department of Defense Joint Technology Office Solid State Laser Technical Advisory Working Group (JTO SSL TAWG) annual meeting (Directed Energy Professional Society annual meeting), Santa Fe, NM, June 2011.
118. J. Ballato, "Advances in Laser and Infrared Ceramics, Single Crystals, and Crystalline Optical Fibers," Air Force Research Laboratory, Dayton, OH, June 2011.
119. J. Ballato, S. Morris, T. Hawkins, P. Foy, C. McMillen, R. Stolen, and R. Rice, "Silicon Fibre," 7th Workshop on Fibre Optics and Passive Components (WFOPC2011), Montreal (Quebec), Canada, July 2011.
120. J. Ballato, "Semiconductor Optical Fiber," Optoelectronics Research Centre, Southampton University, Southampton, UK, September 2011.
121. J. Ballato, S. Morris, T. Hawkins, P. Foy, C. McMillen, R. Stolen, and R. Rice, "Silicon Core Optical Fiber," European Conference on Optical Communications (ECOC), Geneva, Switzerland, September 2011.
122. J. Ballato, S. Morris, T. Hawkins, P. Foy, C. McMillen, R. Stolen, and R. Rice, "Glass-Clad Semiconductor Core Optical Fibers," Materials Science & Technology (MS&T) Annual Meeting, Columbus, OH, October 2011.
123. J. Ballato, "Semiconductor Optical Fiber," colloquium co-sponsored by the Division of Materials Science and Engineering and by the Photonics Center, Boston University, Boston, MA, October 2011.
124. J. Ballato, "Advances in Semiconductor Optical Fiber," West Virginia University, Morgantown, WV, December 2011.
125. J. Ballato, B. Kokuoz, J. Kolis, and C. McMillen, "Processing and Fabrication of Lanthanide Sesquioxide Transparent Ceramics," SPIE Photonics West, January 2012.
126. J. Ballato, "Advances in Semiconductor Optical Fiber," Department of Materials Science and Engineering Colloquium, Rensselaer Polytechnic Institute, Troy, NY, March 2012.
127. J. Ballato, "Semiconductor Optical Fiber," Department of Materials Science and Engineering Colloquium, University of Alabama, Tuscaloosa, AL, February 2012.
128. S. Morris, T. Hawkins, P. Foy, C. McMillen, J. Fan, L. Zhu, R. Stolen, R. Rice, and J. Ballato, "Reactive molten core fabrication of silicon optical fiber," ACeS 2012 Glass and Optical Materials Division conference, St. Louis, MO, May 2012.
129. J. Ballato, S. Morris, T. Hawkins, P. Foy, C. McMillen, R. Stolen, and R. Rice, "Semiconductor Core Optical Fiber," International Symposium on Non-Oxide and New Optical Glasses (ISNOG2012), Saint-Malo, France, July 2012.
130. J. Ballato, "Extraordinary Optical Fibers from Otherwise Boring Materials" Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, September 2012.
131. J. Ballato, A. Evert, P. Dragic, A. James, T. Hawkins, P. Foy, L. Dong, N. Broderick, R. Stolen, and R. Rice, "Longitudinally-Graded Optical Fibers," IEEE Photonics Conference, Burlingame, CA, September 2012.
132. J. Ballato, A. Evert, P. Dragic, T. Hawkins, P. Foy, L. Dong, N. Broderick, R. Stolen, and R. Rice, "Longitudinally-Graded Optical Fibers," Materials Science & Technology (MS&T) Annual Meeting, Pittsburgh, PA, October 2012.

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133. J. Ballato, L. Dong, S. Morris, T. Hawkins, and P. Dragic, "Molten Core Fabrication of Specialty Optical Fiber: Merits and Marvels (and Occasional Misfits)," Workshop on the *Fabrication of Specialty Fibers and Fiber Devices*, Photonic Global Conference, Singapore, Malaysia, December 2012.
134. J. Ballato, C. Kucera, and L. Jacobsohn, "Novel Optical Properties from Solution-Derived Nanoparticles," 3rd International Solvothermal and Hydrothermal Association Conference (ISHA 2013), Austin, TX, January 2013.
135. J. Ballato, "Next Generation Optical Fibers" Department of Physics and Optical Sciences, the University of North Carolina at Charlotte, Charlotte, NC, February 2013.
136. J. Ballato, "The Materials Science of Novel Optical Fibers" Princeton Institute for the Science and Technology of Materials (PRISM) at Princeton University, Princeton, NJ, March 2013.
137. J. Ballato, S. Morris, and T. Hawkins, "Advanced in Semiconductor Core Optical Fiber," Laser Technology for Defense and Security IX, SPIE Defense, Security, and Sensing Conference, Baltimore, MD, April 2013.
138. J. Ballato, "Molten Core Fabrication of Novel Optical Fibers," Innovations in Glass Science and Technology - 2013 Glass and Optical Materials Division (GOMD) Meeting, Glasses for Optoelectronic and Optical Applications Symposium, 10th Pacific Rim Conference on Ceramic and Glass Technology, San Diego, CA, June 2013.
139. J. Ballato, "Molten Core Fabrication of Novel Optical Fibers," *Advanced Fibre Photonics Technologies* workshop, Le Centre National de la Recherche Scientifique, Institute for Engineering and Systems Sciences (INSIS), Paris, France, October 2013.
140. J. Ballato, "Rethinking Optical Fiber," Laboratoire de Physique de la Matière Condensée / CNRS, University of Nice, Nice France, October 2013.
141. S. Karbasi, R. Frazier, K. Koch, T. Hawkins, J. Ballato, and A. Mafi, "Transverse Anderson localization in disordered optical fibers," OSA Frontiers in Optics 2013, Orlando, FL, October 2013.
142. A. Mafi, S. Karbasi, K. Koch, T. Hawkins, J. Ballato, M. Leonetti, and C. Conti, "Anderson Localisation in Fibres," European Conference on Optical Communications (ECOC), Cannes, France, September 2014.
143. J. Ballato and P. Dragic, "Novel Optical Fibers with Intrinsically Low Brillouin Gain," IEEE Photonics Conference (IPC), San Diego, CA, October 2014.
144. J. Ballato, "Simplicity is the Ultimate Sophistication," Departmental Colloquium, Physics and Astronomy, Clemson University, March 2015.
145. J. Ballato, "Optical Properties of Vitreous Materials," The Advanced School on Glasses and Glass-Ceramics, São Carlos, São Paulo, Brazil, August 2015.
146. A. Mafi, S. Karbasi, K. Koch, and J. Ballato, "Transverse Anderson localization and image transport through disordered fibers," SPIE Optics + Photonics, San Diego, CA, August 2015.
147. J. Ballato, T. Hawkins, and P. Dragic, "Rethinking Optical Fiber," European Conference on Optical Communication (ECOC 2015), Valencia, Spain, September 2015.
148. M. Dubinskii, E. J. Friebele, S. Jiang, J. Ballato, and P. Dragic, "Power Scaling Potential of Er-doped Fiber Lasers Based on Advanced Fiber Materials," OSA Advanced Solid State Lasers Conference and Exhibition (ASSL), Berlin, Germany, October 2015.
149. L.M. Xiao, N. Healy, Z. Webber, T. Hawkins, M. Jones, J. Ballato, U. Gibson, and A. C. Peacock, "In-fiber Silicon Microspheres," Asia Communications and Photonics Conference (ACP 2015), Hong Kong SAR, November 2015.
150. J. Ballato, T. Hawkins, and P. Dragic, "New Materials and Functions - Novel Fibre Materials and Fabrication Methods," 4th International Workshop on Specialty Optical Fiber (WSOF 2015), Hong Kong SAR, November 2015.
151. J. Ballato, "Plenty of Room at the Bottom... Nanocomposite Optical Fibers for Ultra-broadband Amplification," Optical Fiber Communications Conference (OFC) workshop on "Do we need anything other than the C-band," Anaheim, CA, March 2016.

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152. J. Ballato, M. Cavillon, and P. Dragic, "Novel Effects from Old Glasses in Next Generation Optical Fibers," Annual Meeting of the Glass and Optical Materials Division of the American Ceramic Society (GOMD 2016), Madison, WI, May 2016.
153. J. Ballato, "Extraordinary Optical Fibers from Otherwise Boring Materials," Corning Glass Summit, Corning, NY, June 2016.
154. A. Peacock, N. Healy, F. Suhailin, S. Mailis, J. Ballato, and U. Gibson, "Crystalline core silicon fibers for optoelectronic applications," OSA Advanced Photonics Congress, Integrated Photonics Conference (IPC), Vancouver, BC, Canada, June 2016.
155. J. Ballato and P. Dragic, "Materials Approaches to Mitigating Parasitic Effects in Optical Networks: Towards the Perfect Optical Fiber," 18th International Conference on Transparent Optical Networks (ICTON), Trento, Italy, July 2016.
156. A. Peacock, N. Healy, J. Ballato, and U. Gibson, "Towards in-fiber silicon photonics," Australian Conference on Optical Fibre Technology (ACOFT), Sydney, Australia, September 2016.
157. J. Ballato, "Back to the Future - Why boring old materials and designs are the answer to next generation optical fibers," 50th anniversary symposium honoring Nobel Laureate Charles Kao's seminal paper on low loss optical fiber, Optical Society of America's Frontiers in Optics (FIO), Fiber Optics and Optical Communications Symposium, Rochester, NY, October 2016.
158. M. Vermillac, J.-F. Lupi, F. Peters, P. Vennéguès, M. Cabié, T. Neisius, C. Kucera, J. Ballato, W. Blanc, "Designing nanoparticles during the drawing step," Conference on Rare-Earth Doped Glass Materials and Fibre Lasers, Trento, Italy, October 2016.
159. J. Ballato and P. Dragic, "Materials Solutions to Parasitic Effects in Fiber Lasers and Amplifiers," Joint international symposium between the Ceramic Society of Japan (CerSJ) and the Glass and Optical Materials Division (GOMD) of the American Ceramic Society (ACerS), Kyoto, Japan, November 2016.
160. J. Ballato, M. Cavillon, C. Kucera, and P. Dragic, "Materials solutions to the nonlinear optical limitations in high power lasers," 20th Annual Southeast Ultrafast Conference (SEUFC), Clemson, SC, January 2017.
161. J. G. Eden, J. Ballato, M. J. F. Digonnet, P. Dragic, A. Mironov, and S. Rand, "Internal cooling of fiber and disc lasers by radiation balancing and other optical and phonon processes: a new AFOSR MURI program," SPIE Photonics West, San Francisco, CA, January 2017.
162. J. Ballato and P. Dragic, "Tailoring the response of stimulated Brillouin scattering in fibers," Optical Fiber Communication Conference and Exposition (OFC) 2017, Los Angeles, CA, March 2017.
163. J. Ballato, "The Molten Core Fabrication of Novel Optical and Optoelectronic Fibers," Materials Research Society (MRS) Spring Conference, Advanced Multifunctional Fibers and Textiles Symposium, Phoenix, AZ, April 2017.
164. J. Ballato and P. Dragic, "Crystalline Semiconductor Core Optical Fibers," 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), Waikoloa, Hawaii, May 2017.
165. J. Ballato, "The Molten Core Fabrication of Novel Optical Fibers," Third International Richard M. Fulrath Symposium on Discontinuous Progress for Ceramic Innovations, 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), Waikoloa, Hawaii, May 2017.
166. J. Ballato M. Vermillac, C. Kucera, and W. Blanc, "Nanoparticle Doping of Optical Fibers – Can Silica Behave like a Fluoride?" Professor Jacques Lucas Honorary Symposium, 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), Waikoloa, Hawaii, May 2017.
167. J. Ballato and T. Hawkins, "The Molten Core Fabrication of Novel Optical Fibers," Norwegian University of Science and Technology (NTNU), Trondheim, Norway, June 2017.
168. J. Ballato and T. Hawkins, "Novel Optical Fibers and How to Make Them (And How NOT to Make them...)," Royal Institute of Technology (KTH), Stockholm, Sweden, June 2017.
169. J. Ballato and P. Dragic "Specialty optical fiber materials and fabrication techniques for lasers," Conference on Lasers and Electro-Optics Europe (CLEO/Europe), Munich, Germany, June 2017.

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170. U. Gibson, M. Fokine, N. Healy, S. Song, S. Svendsen, U. Österberg, A. Peacock, and J. Ballato, "Semiconductor core fibers for optoelectronics," Joint Japanese Society of Applied Physics (JSAP) / Optical Society of America (OSA) Joint Conference on Photonics, Fukuoka, Japan, September 2017.
171. U. J. Gibson, J. Ballato, N. Healy, A. C. Peacock, and M. Fokine "Semiconductor-core optical fibers," Workshop on Specialty Optical Fibers and Their Applications (WSOF2017), Limassol, Cyprus, October 2017.
172. O. Aktas, H. Ren, A. F. J. Runge, T. Hawkins, J. Ballato, U. Gibson, and A. C. Peacock, "Interfacing Telecom Fibers and Silicon Core Fibers with Nano-Spikes for In-Fiber Silicon Devices," Optical Fiber Communication Conference and Exposition (OFC) 2018, San Diego, CA, March 2018.
173. M. Vermillac, H. Fneich, M. Cabié, C. Kucera, D. Borschneck, F. Peters, P. Vennéguès, T. Neisius, S. Chaussedent, D.R. Neuville, A. Mehdi, J. Ballato, and W. Blanc, "Tm-doped nanoparticles in optical fibers," SPIE Photonics Europe 2018, Strasbourg, France, April 2018.
174. J. Ballato, M. Cavillon, and P. D. Dragic, "Vision for advanced laser materials," 14th International Ceramics Congress (ICC), Perugia, Italy, June 2018.
175. P. Dragic, M. Cavillon, C. Kucera, N. Yu, T. Hawkins, and J. Ballato, "Low nonlinearity fiber," OSA Advanced Photonics Congress, Zurich, Switzerland, July 2018.
176. U. J. Gibson, J. Ballato, A. C. Peacock, F. Laurell, and M. Fokine, "Future of Semiconductor-core Optical Fibers," OSA Advanced Photonics Congress, Zurich, Switzerland, July 2018.
177. P. Dragic, M. Cavillon, C. Kucera, J. Parsons, T. Hawkins, and J. Ballato, "Tailoring the Thermo-Optic Coefficient in Silica Optical Fibers," 26th Optical Fiber Sensors conference, Lausanne, Switzerland, September 2018.
178. P. D. Dragic, M. Cavillon, M. Tuggle, N. Yu, C. Kucera, J. Parsons, T. Hawkins, and J. Ballato, "Tailored Glasses Optimized for Optical Fiber-Based Photonic Applications," 13th Pacific Rim Conference on Lasers and Electro-Optics (CLEO Pacific Rim, CLEO-PR 2018), Hong Kong SAR, August 2018.
179. J. Turlier, M. Vermillac, F. Peters, C. Kucera, S. Chaussedent, J. Ballato, and W. Blanc, "Elongating and breaking of nanoparticles during the drawing of optical fibers," D-Photon 2018, 1st International Conference on Dielectric Photonic Devices and Systems Beyond Visible, Bali, Italy, October 2018.
180. J. Ballato, "Simple fibre designs for complex photonics: what nanoparticles, bubbles, and semiconductors have in common with lasers and Anderson localization," Congress of the Australian Institute of Physics, Australian Conference on Optical Fibre Technology (ACOFT) and the Conference on Optoelectronic and Microelectronic Materials and Devices (COMMAD), Perth, Australia, December 2018.
181. J. Ballato, "The materials science and engineering of optical nonlinearities and their mitigation in high power lasers," Department of Materials Science and Engineering, Rensselaer Polytechnic Institute (RPI), Troy, NY, April 2019.
182. M. Cavillon, B. Poumellec, M. Lancry, P. Dragic, and J. Ballato, "Femtosecond laser irradiation in yttrium aluminosilicate glass optical fibers," 25th International Congress on Glass (ICG) and the 100th Annual Meeting of the Glass and Optical Materials Division (GOMD) of the American Ceramic Society (ACerS), Boston, MA, June 2019.
183. M. Cavillon, J. Ballato and P. Dragic, "A materials approach toward the mitigation of nonlinearities in glass optical fibers," 21st International Conference on Transparent Optical Networks (ICTON 2019), Angers, France, July 2019.
184. J. Ballato, T. W. Hawkins, M. Cavillon, and P. D. Dragic, "The materials science and engineering of optical nonlinearities and their mitigation in high power lasers," SPIE Security & Defence 2019, Strasbourg, France, September 2019.
185. N. Yu, M. A. Tuggle, A. E. Mironov, S. Park, C. Kucera, T. W. Hawkins, J. Ballato, and P. D. Dragic, "Luminescence-Quenched Ytterbium-Doped Optical Fiber Microheater and its Applications," SPIE Photonics West, San Francisco, CA, February 2020.

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186. P. Dragic, N. Yu, G. Pan, B. Meehan, M. Tuggle, M. Cavillon, T. Hawkins, and J. Ballato, "Power Scaling of Diffraction-Limited, Narrow-Linewidth Fiber Lasers to Beyond 10 kW," 22nd International Conference on Transparent Optical Networks (ICTON 2020), July 2020; [virtual conference \(COVID-19\)](#).
187. J. Ballato, T. W. Hawkins, and P. D. Dragic, "Advanced Materials for High Energy Fiber Lasers," Lasers, Optics and Photonics (iLASERS-2020), October 2020; [virtual conference \(COVID-19\)](#).
188. J. Ballato, T. W. Hawkins, and P. D. Dragic, "Novel materials for TMI mitigation," SPIE Photonics West 2021 Fiber Lasers XVIII - Special TMI Session II, March 2021; [virtual conference \(COVID-19\)](#).
189. J. Ballato, "The materials science and engineering of high-power lasers," Department of Physics and Astronomy, Augusta University, February 2021; [virtual conference \(COVID-19\)](#).
190. J. Ballato, "Advances in Optical and Optoelectronic Fibers," American Physical Society APS Annual Meeting, March 2021; [virtual conference \(COVID-19\)](#).
191. J. Ballato, "Advanced in semiconductor optical fiber," Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Colloquium Series on Micro and Nanotechnology, March 2021; [virtual conference \(COVID-19\)](#).
192. J. Ballato and P. D. Dragic, "Advances in optical fiber glasses for reduced heat generation," 6th International Richard M. Fulrath Symposium, "Frontiers of Ceramics for a Sustainable Society," 14th Pac Rim Conference on Ceramic and Glass Technology and the Glass and Optical Materials Division of the American Ceramic Society Annual Meeting, December 2021; [virtual conference \(COVID-19\)](#).
193. P. D. Dragic, N. Yu, T. W. Hawkins, M. Cavillon, and J. Ballato, "Multicomponent Glasses and Their Application in Low Nonlinearity Optical Fiber," SPIE Photonics West, San Francisco, CA, January 2022.
194. P.-B. Vigneron, B. Meehan, M. A. Cahoon, T. W. Hawkins, J. Ballato, P. D. Dragic, M. Engholm, T. Boilard, M. Bernier, and M. J. F. Digonnet, "Anti-Stokes cooling in silica and nanoparticle silicate fibers," SPIE Photonics West, San Francisco, CA, January 2022.
195. M. J. F. Digonnet, J. Ballato, and P. D. Dragic, "Anti-Stokes Cooling and Other Thermal-Management Techniques in Fiber Lasers and Amplifiers," SPIE Photonics West, San Francisco, CA, January 2022.
196. J. Ballato, "The Future of Fiber Optics" a webinar in honor of the *International Year of Glass* (IYOG 2022), hosted by the Université Côte d'Azur (Nice, France), February 2022.
197. J. Ballato, "The past, present, and future of glass optical fiber," a webinar in honor of the *International Year of Glass* (IYOG 2022), hosted by the *GlassTrend* (a global consortium of glass companies), March 2022.
198. J. Ballato, "Glass and lasers – A bright future," *National Day of Glass* conference in honor of the *International Year of Glass* (IYOG 2022), American Ceramic Society, Washington, DC, April 2022.
199. J. Ballato, "Materials for Advanced Optical and Optoelectronic Fibers," a webinar in honor of the *International Year of Glass* (IYOG 2022), hosted by the Consiglio Nazionale delle Ricerche and the Istituto di Fotonica e Nanotecnologie- Trento (Trento, Italy), March 2022.
200. P. D. Dragic, N. Yu, B. Meehan, T. W. Hawkins, J. Ballato, M. J. F. Digonnet, "Thermal Management in Fiber Laser Systems," 11th Advanced Lasers and Photon Sources Conference and the OPIC2022: OPTICS & PHOTONICS International Congress, Yokohama, Japan, April 2022.
201. J. Ballato, "Molten core fabrication of novel optical fibers," A Day of Glass in Trento in Celebration of the UN International Year of Glass, Trento, Italy, July 2022.
202. J. Ballato, "The past, present, and future of molten core optical fiber fabrication," a global webinar for Optica (Optical Society of America), August 2022.
203. J. Ballato, "The Future of Glass and Light," Engineering Colloquium, NASA's Goddard Space Flight Center (virtual), September 2022.
204. M. J. F. Digonnet, J. M. Knall, P.-B. Vigneron, M. A. Cahoon, T. W. Hawkins, J. Ballato, T. Boilard, M. Bernier, and P. D. Dragic, "Optically Cooled Yb-Doped Silica Fiber Lasers," 7th International Workshop on Specialty Optical Fibers and their Applications, Adelaide, Australia, December 2022.

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205. J. Ballato, T. W. Hawkins, and P. D. Dragic, “Novel fiber optic materials for reducing nonlinearities,” 12th Advanced Lasers and Photon Sources Conference (ALPS2023), Yokohama, Japan, April 2023.
206. C. Bassett, M. Tuggle, J. Ballato, and A. Mafi, “Embracing Disorder in Optical Fibers: Transverse Anderson Localization, Gain, and Nonlinearity,” 2nd International School and Conference on Disorder in Materials Science, Plankenstetten, Germany, June 2023.
207. N. Vermeulen, D. Espinosa, A. Ball, J. Ballato, P. Boucaud, G. Boudebs, C. L. A. V. Campos, P. D. Dragic, A. S. L. Gomes, M. J. Huttunen, N. Kinsey, R. Mildren, D. Neshev, L. Padilha, M. Pu, R. Secondo, E. Tokunaga, D. Turchinovich, J. Yan, K. Yvind, K. Dolgaleva, and E. W. Van Stryland, “Post-2000 nonlinear optics: data tables and best practices,” Conference on Lasers and Electro-Optics Europe (CLEO Europe 2023), Munich, Germany, June 2023.
208. J. Ballato, T. W. Hawkins, and T. H. Zaengle, “Advances in Semiconductor Nonlinear Optical Fibers and their Application,” Optica Nonlinear Optics Topical Meetings, Honolulu, HI, July 2023.

Contributed Presentations

1. J. Ballato and E. Snitzer, “Fabrication of Fibers with High Rare-Earth Concentrations,” American Ceramic Society Annual Meeting, Cincinnati, OH, April 1993.
2. A. Ballato and J. Ballato, “Measuring Modern Ferroelectrics Accurately,” American Ceramic Society Annual Meeting, Indianapolis, IN, April 1994.
3. M. Dejneka, J. Ballato, R. E. Riman, and E. Snitzer, “Sol-Gel Synthesis of Fluoride Glasses and Thin Films,” American Ceramic Society Annual Meeting, Indianapolis, IN, April 1994.
4. J. Ballato, M. Dejneka, R. E. Riman, and E. Snitzer, “Fabrication of Pr³⁺-Doped Pb-In-Ga-La-Zn Heavy Metal Fluoride Glasses,” American Ceramic Society Annual Meeting, Indianapolis, IN, April 1994.
5. J. Ballato, M. Dejneka, R. E. Riman, and E. Snitzer, “The Effect of Reduced Zirconium on Heavy-Metal Fluoride Glasses,” SPIE Sol-Gel III Conference, San Diego, CA, July 1994.
6. M. Dejneka, J. Ballato, R. E. Riman, and E. Snitzer, “Sol-Gel Synthesis of Fluoride Glasses and Thin Films,” Materials Research Society Annual Meeting, Boston, MA, November 1994.
7. J. Ballato, M. Dejneka, R. E. Riman, and E. Snitzer, “Bulk Properties and Fiber Fabrication of Pr³⁺ Doped Pb-In-Ga-La-Zn Heavy-Metal-Fluoride Glasses,” Materials Research Society Meeting, Boston, MA, November 1994.
8. A. Ballato and J. Ballato, “Modern Piezoceramic Equivalent Networks,” IEEE Ultrasonics Symposium, Seattle, WA, November 1995.
9. J. Ballato, R. E. Riman, and E. Snitzer, “Sol-Gel Synthesis of Thin-Film Fluoride Materials for Integrated Optic Applications,” American Ceramic Society Annual Meeting, Indianapolis, IN, April 1996.
10. J. Ballato, R. E. Riman, S. Laffey, and J. Vig, “Etching Quartz Crystals in Anhydrous HF,” IEEE Frequency Control Symposium, Honolulu, HI, June 1996.
11. A. Ballato, J. Kelly, J. Ballato, and A. Safari, “Dissipation in Ceramic Resonators and Transducers,” IEEE Frequency Control Symposium, Honolulu, HI, June 1996.
12. J. Ballato, R. E. Riman, and E. Snitzer, “Novel Applications of Fluoride Optical Materials: Sol-Gel Synthesis for Planar Integrated Photonics,” 10th International Symposium on Non-Oxide Glasses, Corning, NY, June 1996.
13. J. Ballato, R. E. Riman, and E. Snitzer, “Novel Applications of Fluoride Optical Materials: Sol-Gel Synthesis for Planar Integrated Photonics,” **Gordon Conference**, Tilton, NH, June 1996.
14. A. Ballato and J. Ballato, “Accurate Networks for Thin-Film Piezoelectric Resonators,” 9th International Symposium on the Applications of Ferroelectrics (ISAF), Piscataway, NJ, August 1996.
15. C. Haines, J. Ballato, and R. E. Riman, “Fluoride Fibers by Sol-Gel Core Deposition,” American Ceramic Society Annual Meeting, Cincinnati, OH, May 1997.

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16. J. Ballato, J. Plewa, R. E. Riman, and E. Snitzer, "Sol-Gel Synthesis of Multicomponent Fluorides Glasses," American Ceramic Society Annual Meeting, Cincinnati, OH, May 1997.
17. J. Ballato, R. E. Riman, and E. Snitzer, "Luminescent Behavior of Sol-Gel-Derived Pr^{3+} and Dy^{3+} Doped Lanthanum Halides for 1.3 μm Optical Amplification," American Ceramic Society Annual Meeting, Cincinnati, OH, May 1997.
18. J. Ballato, R. E. Riman, M. Lencka, L. McCandlish, B. Gersten, A. Anderko, and S. Cho, "Intelligent Engineering of Hydrothermal Reactions," Fifth European Conference on Ceramics, Versailles, France, June 1997.
19. J. Ballato, R. E. Riman, and E. Snitzer, "Sol-Gel Synthesis of Rare-Earth-Doped Lanthanum Halides for Highly Efficient Optical Amplification," Optical Society of America - Optical Amplifiers and Their Applications, Victoria, B. C., Canada, July 1997.
20. R. Esmacher and J. Ballato, "Rare Earth Doped Electro-Optic Ceramics for Tunable Photonic Components," American Ceramic Society Annual Meeting, Cincinnati, OH, May 1998.
21. A. James and J. Ballato, "Highly Tunable Photonic Bandgap Effects in Colloidal Crystals," Optical Society of America Annual Meeting, Baltimore, MD, October 1998.
22. D. Carroll, R. Czerw, S. Hoshi, D. Benenti, E. Gregory, D. Tarbox, J. Ballato, and P. Ajayan, "Optical Properties of Carbon Nanotube-PMMA Composites," American Physical Society Annual Meeting, Atlanta, GA, March 1999.
23. J. Ballato and A. James, "Tunable Photonic Bandgap Effects in Colloidal Ceramic Crystals," American Ceramic Society Annual Meeting, Indianapolis, IN, April 1999.
24. R. Esmacher, M. Dejneka and J. Ballato, " Er^{3+} and Nd^{3+} Doped Electro-Optic PLZTs as Tunable Photonic Devices," American Ceramic Society Annual Meeting, Indianapolis, IN, April 1999.
25. W. Nothwang, R. Schwartz, and J. Ballato, "Equivalent Circuit Modeling of Piezoelectric RAINBOW Actuators," American Ceramic Society Annual Meeting, Indianapolis, IN, April 1999.
26. J. Ballato, J. DiMaio, and E. Gulliver, "Photonic Band Engineering Through Tailored Microstructural Order/Disorder and its Application," American Ceramic Society, Glass and Optical Materials Division Meeting, Cleveland, OH, October 1999.
27. J. Ballato and M. Dejneka, "Rare-Earth Doped PLZT for Active Electro-Optic Devices," American Ceramic Society, Glass and Optical Materials Division Meeting, Cleveland, OH, October 1999.
28. E. Gregory, D. Tarbox, R. Czerw, J. Ballato, P. Ajayan, and D. Carroll, "Optical Characterization of PMMA-Carbon Nanotube Nanocomposites," Materials Research Society Annual Meeting, Boston, MA, December 1999.
29. J. Ballato, E. Gulliver, J. DiMaio, and A. James, "Tailoring Visible Photonic Bandgaps through Microstructural Order and Coupled Material Effects in Silica Colloidal Crystals," Fourth International Topical Conference on Optical Probes in Conjugated Polymers and Photonic Crystals, Salt Lake City, UT, February 2000.
30. R. Schwartz, J. Ballato, W. Nothwang, and P. Laoratanakul, "Understanding Mechanics and Stress Effects in Rainbow and Thunder Stress-Biased Actuators," SPIE 7th International Symposium on Smart Structures and Materials, Newport Beach, CA, March 2000.
31. J. Ballato, J. DiMaio, and D. Carroll, "Direct Quantification of Physical Properties in Particulate Systems," American Ceramic Society, Southeastern Sectional Meeting, Clemson, SC, March 2000.
32. N. Nisanart, R. Schwartz, D. Dinger, and J. Ballato, "Chemical and Mixing Effects in the Deflocculation of Barium Titanate Suspensions," American Ceramic Society, Southeastern Sectional Meeting, Clemson, SC, March 2000.
33. J. Kolis, H. Giesber, W. Pennington, and J. Ballato, "Getting Back to Bases: Hydrothermal Synthesis as a route to Lanthanide Borates with useful Optoelectronic Applications," American Chemical Society Annual Meeting, San Francisco, CA, March 2000.

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34. H. Shah, D. Smith, R. Czerw, D. Carroll, L. Goldner, J. Hwang, and J. Ballato, "Fluoropolymer Nanotube Composites for Coatings and Nanoscopic Probes," Materials Research Society Annual Meeting, San Francisco, CA, April 2000.
35. J. Ballato, R. Schwartz, and A. Ballato, "Modeling of RAINBOW Ceramic Actuators and Other Functionally Gradient Structures using a New Network Formalism with the Inclusion of Loss," American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.
36. W. Nothwang, R. Schwartz, and J. Ballato, "Characterization of the Effects of Mass Loading on the Strain," American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.
37. W. Nothwang, R. Schwartz, and J. Ballato, "The Use of an Equivalent Circuit Model to Describe Aging and Fatigue Effects in Piezoelectric Ceramics," American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.
38. J. Ballato, E. Gulliver, D. Carroll, J. DiMaio, R. Riman, and T. Taylor, "Structure-Property Relationships in Colloidal Crystal Photonic Bandgap Structures," American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.
39. H. Jiang, J. Ballato, D. Rhonehouse, J. Myers, and M. Myers, "Rare-Earth Doped Phosphate Glasses for Neodymium Laser Systems with enhanced pump power conversion," American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.
40. R. Schwartz, W. Nothwang, and J. Ballato, "Aging and Fatigue Effects in Thunder Stress-Biased Ceramics," 11th International Symposium on the Applications of Ferroelectrics (ISAF), Maui, HI, July 2000.
41. J. Kolis, H. Giesber, J. Ballato, and W. Pennington, "Hydrothermal Growth of Lanthanide Orthoborate Crystals for Deep UV Laser Applications," American Association of Crystal Growth Conference, Vail, CO, August 2000.
42. J. Ballato, M. Dejneka, R. Esmacher, and R. Schwartz, "Rare-Earth Doped Ferroelectrics for Active Electro-Optic Devices," SPIE/OSA Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging, Charlotte, NC, September 2000.
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254. M. Vermillac, J.F. Lupi, M. Ude, S. Trzesien, B. Dussardier, W. Blanc, O. Totterau, P. Vennegues, C. Kucera, and J. Ballato, "Spectroscopic properties of $\text{LaF}_3\text{:Tm}^{3+}$ nanoparticles-doped silica optical fibers," Optical Society of America Advanced Photonics Congress, Specialty Optical Fiber (SOF) Symposium, Barcelona, Spain, July 2014.
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267. B. Abaie, E. Mobini, S. Karbasi, J. Ballato, and A. Mafi, "Observation of lasing in an Anderson localizing optical fiber," Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, June 2016.
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269. M. Tuggle, C. Kucera, T. Hawkins, M. Jones, J. Furtick and J. Ballato, "Novel Fabrication of Rare-Earth doped Aluminosilicate Optical Fiber," 6th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'16), Greenville, SC, June 2016.
270. M. Vermillac, J.-F. Lupi, C. Kucera, J. Ballato, P. Vennéguès, D. Neuville, J.-B. Tissot, H. Fneich, A. Medhi, and W. Blanc, "Use of Thulium-doped LaF₃ nanoparticles to enhance thulium ³H₄ lifetime in Silica-Based Optical Fibers," 6th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'16), Greenville, SC, June 2016.
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278. S. Pyshkin and J. Ballato, "Properties of GaP Studied over 50 Years," 8th International Conference on Materials Science and Condensed Matter Physics, Chisinau, Republic of Moldova, September 2016.
279. M. Fokine, T. Hawkins, M. Jones, J. Ballato, and U. Gibson, "CO₂ Laser Structuring of Semiconductor-core Glass Fiber," Optical Society of America's Frontiers in Optics (FiO), Fiber Optics and Optical Communications Symposium, Rochester, NY, October 2016.
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286. M. Vermillac, H. Fneich, J.-F. Lupi, M. Cabié, D. Borschneck, A. Mehdi, F. Peters, P. Vennéguès, T. Neisius, C. Kucera, J. Ballato, and W. Blanc, "Nanoparticules dans les fibres optiques : Amélioration de la luminescence du thulium et contrôle de leurs tailles," La Journée du Club Optique et Microondes de la Société Française d'Optique, Limoges, July 2017.
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298. A. L. Vargas, C. J. Kucera, C. C. Baker, A. A. Burdett, E. J. Friebele, L. B. Shaw, J. S. Sanghera, and J. Ballato, "Rare-Earth Nanoparticle Doped Optical Fibers and Fiber Lasers," 20th Annual Directed Energy Science and Technology Symposium, Oxnard, California, February 2018.

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300. C. Baker, E. J. Friebele, A. Burdett, L. B. Shaw, S. R. Bowman, W. Kim, J. Sanghera, J. Ballato, C. Kucera, A. Vargas, A. Hemming, N. Simikov, and J. Haub, "Recent advances in holmium doped fibers for high-energy lasers," SPIE Defense + Commercial Sensing 2018, Orlando, FL, April 2018.
301. B. Abaie, T. Hawkins, J. Ballato, and Ar. Mafi, "Wide spectral tuning range in an Anderson localizing fiber laser," Conference on Lasers and Electro-Optics (CLEO): 2018, San Jose, CA, May 2018.
302. N. Yu, M. Cavillon, C. Kucera, T. Hawkins, J. Ballato, and P. Dragic, "Low Quantum Defect Fiber Lasers via Yb-Doped Multicomponent Fluorosilicate Optical Fiber," Conference on Lasers and Electro-Optics (CLEO): 2018, San Jose, CA, May 2018.
303. H. Ren, L. Shen, J. Campling, A. F. J. Runge, O. Aktas, T. Hawkins, P. Horak, J. Ballato, U. Gibson, and A. C. Peacock, "Octave-spanning supercontinuum generation in a dispersion managed tapered crystalline silicon core fiber," Conference on Lasers and Electro-Optics (CLEO): 2018, San Jose, CA, May 2018.
304. T. Sjørgård, K. Mühlberger, W. Wu, T. Hawkins, J. Ballato, M. Fokine, and U. Gibson, "Reduced loss in SiGe-core optical fibers," Conference on Lasers and Electro-Optics (CLEO): 2018, San Jose, CA, May 2018.
305. W. Blanc, M. Vermillac, F. Peters, C. Kucera, M. A. Tuggle, T. W. Hawkins, and J. Ballato, "Drawing optical fibers: elongating bubbles, breaking nanoparticles," 1st International Conference on Optics, Photonics and Lasers (OPAL' 2018), Barcelona, Spain, May 2018.
306. M. Vermillac, M. Cabié, D. Borschneck, J.-F. Lupi, F. Peters, P. Vennéguès, T. Neisius, C. Kucera, J. Ballato, and W. Blanc, "Elongation, break-up, dissolution and growth of nanoparticles during the fiber drawing of silica-based optical preforms," 15th Physics of Non-Crystalline Solids and 14th European Society of Glass Conference, Saint-Malo, France, July 2018.
307. S. Pyshkin and J. Ballato, "New prospects for electronics," 9th International Conference on materials science and condensed matter physics, Chisinau, Moldova, September 2018.
308. E. Zhang, A. Dickey, M. Burdette, M. Rich, K. Cannon, I. Bandera, M. Bolding, J. Ballato, J. W. Kolis, S. H. Foulger, "Development of nano yttrium orthosilicate for optogenetics: prefiguring to a method for non-aggregated particles," Southeastern Regional Meeting of the American Chemical Society (SERMACS), Savannah, GA, November 2018.
309. M. Vermillac, J. Turlier, M. Cabié, T. Neisius, D. Borschneck, F. Peters, C. Kucera, M. A. Tuggle, T. W. Hawkins, S. Chaussedent, J. Ballato, and W. Blanc, "Drawing optical fibers: a top-down approach to shape nanoparticles," C'Nano 2018 Nanoscience Conference, Toulon, France December 2018.
310. J. M. Knall, P. Dragic, J. Ballato, and M. Dignonnet, "Experimental investigations of spectroscopy and anti-Stokes fluorescence cooling in Yb-doped silicate fibers," SPIE Photonics West, San Francisco, CA, February 2019.
311. P. Dragic, M. Cavillon, C. Kucera, T. Hawkins, and J. Ballato, "Progress Towards the Development of Intrinsically Low-Nonlinearity Optical Fibers," *Laser Technology for Defense and Security XV* Conference of the SPIE Defense + Commercial Sensing 2019 Symposium, Baltimore, MD, April 2019.
312. E. Zhang, A. Dickey, M. Burdette, M. Rich, K. Cannon, I. Bandera, M. Bolding, J. Ballato, J. W. Kolis, and S. H. Foulger, "pDVB Old polymer new tricks: coupling organic and inorganic chemistry for nanoparticle synthesis and noninvasive optogenetics applications," American Chemical Society National Meeting, Orlando, FL, March 2019.
313. A. L. Vargas, C. Kucera, C. Baker, and J. Ballato, "Rare-Earth Nanoparticle Doped Fiber Lasers," Annual Directed Energy Science and Technology Symposium, Destin, FL April 2019.
314. J. Ballato, M. Cavillon, P. Dragic, B. Kokuzov, C. Kucera, and T. Hawkins, "Glass development for high power optical fiber lasers," 25th International Congress on Glass (ICG) and the 100th Annual Meeting of

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the Glass and Optical Materials Division (GOMD) of the American Ceramic Society (ACerS), Boston, MA, June 2019.

315. D. Wu, L. Shen, H. Ren, T. Hawkins, J. Ballato, U. J. Gibson, and A. C. Peacock, "Broad-band optical parametric amplification in a tapered silicon core fiber pumped in the telecom band," Conference on Lasers & Electro-Optics / Europe and European Quantum Electronics Conference (CLEO® / Europe-EQEC), Munich, Germany, June 2019.
316. P. Dragic, M. Cavillon, C. Kucera, J. Parsons, T. Hawkins, and J. Ballato, "Athermal Optical Fibers for Sensing Applications," OSA Optical Sensors and Sensing Congress, San Jose, CA, June 2019.
317. E. Zhang, A. Dickey, Y. Bandera, J. Ballato, J. Kolis, and S. Foulger, "Control in high temperature crystallization of monodisperse and optically active nanomaterials for noninvasive optogenetics," Gordon Research Conference on Crystal Growth and Assembly, Manchester, NH, June 2019.
318. C. Kucera, M. A. Tuggle, T. W. Hawkins, M. Cavillon, G. Pan, N. Yu, P. D. Dragic, and J. Ballato, "Reactive molten core, rare-earth doped optical fiber employing in-situ metal oxidation," 9th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'19), Nice, France, September 2019.
319. M. Engholm, M. Tuggle, C. Kucera, T. W. Hawkins, P. D. Dragic, and J. Ballato, "New insights into the spectroscopic properties of Yb-doped YAG-derived all-glass optical fibers," 9th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'19), Nice, France, September 2019.
320. P. Dragic, N. Yu, J. Knall, C. Kucera, T. W. Hawkins, M. Engholm, A. Mironov, J. G. Eden, M. Digonnet, and J. Ballato, "Towards laser cooling in rare earth doped silicate glass fibers," 9th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'19), Nice, France, September 2019.
321. C. Guillermer, M. Vermillac, Z. Lu, C. Kucera, J. Ballato, B. Lewis, and W. Blanc, "Chemical Characterization of LaF₃:Tm³⁺ Doped Phase-Separated Dielectric Nano-Particles (DNPs) via Secondary Ion Mass Spectrometry (SIMS) Imaging," 9th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE'19), Nice, France, September 2019.
322. F. Travasso, H. Vocca, T. Tomaru, T. Ushiba, T. Suzuki, A. Piluso, D. Aisa, U. J. Gibson, J. Ballato, and T. W. Hawkins, "Towards a silicon monolithic suspension," 2nd GRAVitational - wave Science & technology Symposium (GRASS 2019), Padova, Italy, October 2019.
323. H. A. Qiao, M. K. Murphy, B. J. Riley, J. R. Roth, S. W. Martin, J. Ballato, "Gamma irradiation of novel optical glasses at elevated temperature," American Nuclear Society (ANS) Winter Meeting and Technology Expo, Washington, DC, November 2019.
324. M. A. Tuggle, T. W. Hawkins, N. Yu, G. Pan, J. Gragg, C. Kucera, P. D. Dragic, and J. Ballato, "Applications of novel metal-derived optical fibers," 6th International Workshop on Specialty Optical Fiber (WSOF), Charleston, SC November 2019.
325. W. Wu, S. Song, M. H. Balci, F. Laurell, P. R. Cantwell, J. Ballato, and U. J. Gibson, "Single crystal semiconductor-core optical fiber," 6th International Workshop on Specialty Optical Fiber (WSOF), Charleston, SC November 2019.
326. N. Yu, M. Cavillon, C. Kucera, T. W. Hawkins, J. Ballato, and P. D. Dragic, "Low quantum defect fiber lasers via Yb-doped fluorosilicate optical fiber," 6th International Workshop on Specialty Optical Fiber (WSOF), Charleston, SC November 2019.
327. N. Yu, M. A. Tuggle, C. Kucera, T. W. Hawkins, J. Ballato, and P. Dragic, "All-optically-driven and all-optical-fiber modulator via luminescence quenched Yb-doped fiber," 6th International Workshop on Specialty Optical Fiber (WSOF), Charleston, SC November 2019.
328. S. Jagannathan, L. Ackerman, W. Chen, M. A. Tuggle, M. Cavillon, T. W. Hawkins, J. Ballato, and P. D. Dragic, "Random Lasing from Optical Fibers with Phase-Separated Glass Cores," 6th International Workshop on Specialty Optical Fiber (WSOF), Charleston, SC November 2019.

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330. E. Zhang, A. Dickey, Y. Bandera, I. Foulger, J. Anker, J. Ballato, J. Kolis, and S. H. Foulger, "High-temperature crystallization of monodisperse and optically active lanthanide nanoparticulates for noninvasive optogenetics," Fall Materials Research Society (MRS) Meeting, Boston, MA, December 2019.
331. E. Zhang, A. Dickey, Y. Bandera, H. Jones, I. Foulger, J. Ballato, J. Kolis, and S. H. Foulger, "A material's approach to noninvasive optogenetics by coupling x-rays and sub-100 nm silicate scintillators," 2019 Optogenetic Technologies and Applications Conference, Boston, MA, December 2019.
332. C. Bassett, M. Peysokhan, E. Mobini, M. A. Tuggle, J. Ballato, and A. Mafi, "Characterization of the Yb-doped glass Anderson localizing optical fiber," SPIE Photonics West, San Francisco, CA, February 2020.
333. L. Cheng, L. Andre, P. D. Dragic, T. W. Hawkins, J. Ballato, and S. C. Rand, "Self-cooling experiments in a small core YAG-derived glass fiber," SPIE Photonics West, San Francisco, CA, February 2020.
334. E. Zhang, A. Dickey, Y. Bandera, H. Jones, I. Foulger, J. Ballato, J. Kolis, and S. H. Foulger, "Expanding the colloidal toolkit for optogenetics and x-ray active nanoparticles," 259th National Meeting and Exposition of the American Chemical Society, Philadelphia, PA, March 2020.
335. M. Peysokhan, E. M. Souchelmaei, C. R. Bassett, J. Ballato, M. A. Tuggle, and A. Mafi, "Optical pulse propagation in transverse Anderson localization optical fibers," American Physical Society (APS) Annual Meeting, Denver, CO, March 2020.
336. B. Meehan, T. W. Hawkins, P. Dragic, and J. Ballato, "Materials Mitigation of Optical Nonlinearities for High Power Lasers" 2020 Annual Directed Energy Science & Technology Symposium, Directed Energy Professional Society (DEPS), United States Military Academy, West Point, NY, March 2020.
337. M. Cavillon, Y. Wang, J. Ballato, B. Poumellec, M. Lancry, "Thermal stability of femtosecond laser-induced modifications in optical glasses," Annual Meeting of the Glass and Optical Materials Division (GOMD) of the American Ceramic Society (ACerS), New Orleans, LA, May 2020.
338. D. Wu, L. Shen, C. Lacava, P. Petropoulos, T. W. Hawkins, J. Ballato, U. J. Gibson, and A. C. Peacock, "Tapered submicron silicon core fiber for broadband wavelength conversion," Conference on Lasers & Electro-Optics (CLEO), San Jose, CA, May 2020.
339. N. Yu, A. E. Mironov, S. Park, M. A. Tuggle, J. Gragg, C. Kucera, T. W. Hawkins, J. Ballato, J. G. Eden, and P. D. Dragic, "All-optically-driven and all-optical-fiber vacuum gauge via ytterbium-doped optical fiber microheater," 27th International Conference on Optical Fiber Sensors, Alexandria, Virginia, June 2020.
340. Y. Wang, M. Cavillon, J. Ballato, B. Poumellec, and M. Lancry, "Thermal Stability of Type II Modifications by IR Femtosecond Laser in Highly-Doped Aluminosilicate Glass Optical Fibres," OSA Advanced Photonics Congress / Program & Topics Bragg Gratings, Photosensitivity and Poling in Waveguides and Materials (BGPP), Montreal, Canada, July 2020.
341. M. Huang, H. Ren, L. Shen, D. Wu, S. Sun, T. W. Hawkins, J. Ballato, U. J. Gibson, and A. C. Peacock, "Stimulated Raman Scattering in a Tapered Submicron Silicon Core Fiber," Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2021.
342. Y. Wang, M. Cavillon, J. Ballato, T. Elsmann, M. Rothhardt, B. Poumellec, and M. Lancry, "Thermal Stability of Type II Modifications by IR Femtosecond Laser in Highly-Doped Aluminosilicate Glass Optical Fibers," Conference on Lasers and Electro-Optics / Europe – European Quantum Electronics Conference (CLEO/Europe-EQEC 2021), Munich, Germany, June 2021.
343. R. Sohanpal, H. Ren, L. Shen, C. Deakin, A. M. Heidt, T. W. Hawkins, J. Ballato, U. J. Gibson, A. C. Peacock, and Z. Liu, "Parametric frequency comb generation using silicon core fiber," OSA Optical Fiber Communication Conference and Exposition (OFC), San Francisco, CA, June 2021.
344. Y. Wang, M. Cavillon, J. Ballato, T. Elsmann, M. Rothhardt, B. Poumellec, and M. Lancry, "Femtosecond Laser Induced Nanogratings for Harsh Environment Operations using High Al₂O₃-containing

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- Aluminosilicate Fibers,” 13th Symposium on SiO₂, Advanced Dielectrics and related Devices (SiO₂ 2021), June 2021 (virtual).
345. B. Upadhyay, J. Bertrand, E. Verlage, S. Saini, and K. Madathil, “Investigating the Learning gains associated with Virtual Reality (VR) Simulations in Photonics Manufacturing Education,” 65th International Annual Meeting of the Human Factors & Ergonomics Society, Baltimore, MD, October 2021.
346. S. Sun, M. Huang, D. Wu, L. Shen, H. Ren, T. W. Hawkins, J. Ballato, U. J. Gibson, G. Mashanovich, and A. C. Peacock, “Raman Enhanced Four-Wave Mixing in Silicon Core Fibers,” IEEE Photonics Conference, virtual, October 2021.
347. C. Bassett, M. A. Tuggle, J. Ballato, and A. Mafi, “Characterizing Gain Properties of a Yb-doped Silica Transverse Anderson Localizing Fiber,” OSA Frontiers in Optics, Washington, DC, October 2021.
348. N. Yu, K. V. Desai, A. E. Mironov, M. Xiong, M. Cavillon, T. W. Hawkins, J. Ballato, J. G. Eden, and P. D. Dragic, “Stokes and anti-Stokes pumped Yb-doped fiber lasers,” OSA Frontiers in Optics, Washington, DC, October 2021.
349. J. Ballato, P. D. Dragic, and T. W. Hawkins, “Advanced glasses and optical fibers for high energy lasers,” 14th PacRim Conference on Ceramic and Glass Technology and the Glass and Optical Materials Division of the American Ceramic Society Annual Meeting, Vancouver, Canada, December 2021.
350. J. Knall, P.-B. Vigneron, M. Engholm, P. D. Dragic, N. Yu, J. Ballato, M. Bernier, and M. J. F. Digonnet, “Laser cooling in a silica optical fiber at atmospheric pressure,” 14th PacRim Conference on Ceramic and Glass Technology and the Glass and Optical Materials Division of the American Ceramic Society Annual Meeting, Vancouver, Canada, December 2021.
351. E. Verlage, S. Saini, G. Stump, S. Rayyan, K. Madathil, J. Ballato, J. Bertrand, R. Kosciolk, T. Morrissey, C. T. Gabbianelli, G. Westerman, L. Kimerling, “Workforce Training for Optics and Photonics Manufacturing using Desktop-VR Simulations, Data Visualization, and Game-Based Learning,” 2021 Interservice/Industry Training, Simulation, and Education Conference, Orlando, FL, December 2021.
352. B. Upadhyay, P. Manikonda, E. Rosopa, J. Bertrand, J. Ballato, E. Verlage, S. Saini, and K. C. Madathil, “Developing a Virtual Reality Simulation Using a User Centered Design Process and Investigating the Efficacy of Virtual Reality Simulation to Support Fiber Optic Manufacturing,” Institute of Industrial and Systems Engineer (IISE) Annual Conference & Expo, Seattle, WA, May 2022.
353. S. Sun, M. Huang, D. Wu, L. Shen, T. W. Hawkins, J. Ballato, U. J. Gibson, G. Z. Mashanovich, and A. C. Peacock, “Role of phase-matching on Raman-enhanced FWM in silicon core fibers,” Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2022.
354. M. Huang, D. Wu, H. Ren, L. Shen, T. W. Hawkins, J. Ballato, U. J. Gibson, J. Sipe, R. Slavik, M. Liscidini, and A. C. Peacock, “Phase and Amplitude Imaging using Undetected Photon via Four-wave Mixing in Silicon Core Fibers,” Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2022.
355. M. P. Stone, T. W. Hawkins, P. D. Dragic, and J. Ballato, “Novel Low Nonlinearity Optical Fibers Based on the Molten Core Derived Method,” Glass and Optical Materials Division of the American Ceramic Society, Baltimore, MD, May 2022.
356. M. A. Cahoon, B. Meehan, M. Engholm, P. D. Dragic, M. J. F. Digonnet, and J. Ballato, “Laser cooling in a nanoparticle-doped silica optical fiber,” Glass and Optical Materials Division of the American Ceramic Society, Baltimore, MD, May 2022.
357. B. Meehan, T. W. Hawkins, P. Dragic, and J. Ballato, “Materials Mitigation of Optical Nonlinearities for High Power Fiber Lasers,” Glass and Optical Materials Division of the American Ceramic Society, Baltimore, MD, May 2022.
358. H. Francois-Saint-Cyr, R. Passey, C. Guillermier, I. Martin, L. Casalena, J. Ballato, P. Le Coustumer, and W. Blanc, “2D and 3D structural evolution and chemical characterization of nanoparticles in fiber optics,” Glass and Optical Materials Division of the American Ceramic Society Annual Meeting, Baltimore, MD, May 2022.

Appendix A: Curriculum Vitae – Dr. John Ballato

359. A. R. Pietros, K. Rebeszko, J. R. Rosenbaum, M. P. Stone, T. W. Hawkins, M. Cavillon, J. Ballato, and P. D. Dragic, "Luminescence Thermometry via Intense Green Defect Emission from an Infrared-Pumped Fluorosilicate Optical Fiber," 27th International Conference on Optical Fiber Sensors, Alexandria, VA, August 2022.
360. A. S. Lima, D. C. Silva, J. H. L. Silva, M. V. dos Santos Rezende, D. V. Sampaio, J. Ballato, and R. S. Silva, "Influence of Dy concentration on persistent luminescent in sintered BaAl₂O₄:Eu²⁺, Dy³⁺ ceramics," Brazilian Congress of Materials Engineering and Science (CBECiMat), Águas de Lindóia, Brazil, November 2022.
361. T. Zaengle, U. J. Gibson, T. W. Hawkins, C. McMillen, B. Ghimire, A. M. Rao, and J. Ballato, "Volatile Crystalline Semiconductor Core Fibers," 7th International Workshop on Specialty Optical Fibers and their Applications, Adelaide, Australia, December 2022.
362. M. P. Stone, T. W. Hawkins, M. Cavillon, P. D. Dragic, and J. Ballato, "Compositionally Manipulating Nonlinearities in Novel Optical Fibers Based on the Molten Core Method," 7th International Workshop on Specialty Optical Fibers and their Applications, Adelaide, Australia, December 2022.
363. M. A. Cahoon, B. Meehan, T. W. Hawkins, C. McMillen, P. D. Dragic, M. J. F. Digonnet, and J. Ballato, "On the evolution of nanoparticles in nanoparticle-doped optical fibers," 7th International Workshop on Specialty Optical Fibers and their Applications, Adelaide, Australia, December 2022.
364. J. Ballato, T. Zaengle, and T. W. Hawkins, "In-fiber crystal growth," SPIE Photonics West, Solid State Lasers XXXII: Technology and Devices (Conference LA101), San Francisco, CA, February 2023.
365. M. J. F. Digonnet, P.-B. Vigneron, M. A. Cahoon, B. Meehan, T. W. Hawkins, J. Ballato, T. Boilard, M. Bernier, and P. D. Dragic, "Cooling Yb-doped nanoparticle silica fibers using anti-Stokes pumping," SPIE Photonics West, Photonic Heat Engines: Science and Applications V (Conference OE504), San Francisco, CA, February 2023.
366. L. Dong, J. Kolis, and J. Ballato, "Power Scaling Potential of Single Crystal Fiber Amplifiers," SPIE Defense & Security Conference, Orlando, FL, May 2023.
367. M. A. Cahoon, B. Meehan, T. W. Hawkins, C. McMillen, P. Antonick, R. E. Riman, P. D. Dragic, M. J. F. Digonnet, and J. Ballato, "On the evolution of nanoparticles in nanoparticle-doped optical fibers," Glass and Optical Materials Division of the American Ceramic Society, New Orleans, LA, June 2023.
368. A. R. Pietros, K. Rebeszko, T. W. Hawkins, M. Cavillon, J. Ballato, and P. D. Dragic, "Writable and Erasable Second Harmonic Generation from Crystal-Derived All-Glass Optical Fibers," Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2023.
369. A. R. Pietros, K. Rebeszko, J. R. Rosenbaum, M. P. Stone, A. Brasovs, K. G. Kornev, T. W. Hawkins, M. Cavillon, J. Ballato, and P. D. Dragic, "Strong Visible Defect Luminescence From Infrared-Pumped Barium Fluorosilicate Glass Fiber," Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2023.
370. S. Saini, E. Verlage, A. Agarwal, D. Weninger, S. Serna, S. Rayyan, G. Stump, T. Morrissey, C. Gabbianelli, I. Fay, C. Feeley, Y. Yuan, J. Bertrand, B. Upadhyay, A. Jain, R. Eberhardt, A. Kost, J. Ballato, K. Madathil, S. P. Sundararajan, K. Cicek, D. Gastaldo, J. Perry, E. Klopfer, R. Kirchain, R. Roth, F. Field, E. Moore, G. Westerman, and L. C. Kimerling, "Skilling for and Acculturation to Integrated Photonics Industry Using VR Simulations, Game-Based Learning, and Augmented Reality Games," American Society for Engineering Education (ASEE) Annual Conference and Exposition, Baltimore, MD, June 2023.
371. L. Dong, J. Ballato, and J. Kolis, "Power Scaling Limits of Diffraction-limited Fibre Amplifiers Considering Transverse Mode Instability," Conference on Lasers and Electro-Optics - Europe, Munich, Germany, June 2023.
372. M. Huang, S. Sun, T. S. Saini, Q. Fu, L. Xu, D. Wu, H. Ren, L. Shen, T. W. Hawkins, J. Ballato, and A. C. Peacock, "Mid-infrared Spontaneous and Stimulated Raman Scattering in a Silicon Core Fiber," Conference on Lasers and Electro-Optics Europe (CLEO Europe 2023), Munich, Germany, June 2023.
373. D. Wu, T. S. Saini, S. Sun, L. Shen, M. Huang, T. W. Hawkins, J. Ballato, and A. C. Peacock, "Broadband MIR wavelength conversion in a tapered silicon core fiber," Conference on Lasers and Electro-Optics Europe (CLEO Europe 2023), Munich, Germany, June 2023.

Appendix A: Curriculum Vitae – Dr. John Ballato

374. N. Vermeulen, D. Espinosa, A. Ball, J. Ballato, P. Boucaud, G. Boudebs, C. L. A. V. Campos, P. D. Dragic, A. S. L. Gomes, M. J. Huttunen, N. Kinsey, R. Mildren, D. Neshev, L. Padilha, M. Pu, R. Secondo, E. Tokunaga, D. Turchinovich, J. Yan, K. Yvind, K. Dolgaleva, and E. W. Van Stryland, "Data tables and best practices for post-2000 nonlinear-optical materials and measurements," Optica Nonlinear Optics Topical Meetings, Honolulu, HI, July 2023.
375. J. Ballato, T. W. Hawkins, B. Meehan, M. A. Cahoon, P. D. Dragic, M. Engholm, and M. J. F. Digonnet, "The material science and engineering of anti-Stokes fluorescence cooling in silica optical fibres," 20th International Conference on Luminescence (ICL'2023), Paris, France, August 2023.
376. M. P. Stone, T. W. Hawkins, and J. Ballato, "Pushing Compositional Limits of Optical Fibers Fabricated Using the Molten Core Method," Materials Science & Technology Technical Meeting and Exhibition (MS&T'23), Columbus, OH, October 2023.
377. T. Zaengle, U. J. Gibson, T. W. Hawkins, C. McMillen, and J. Ballato, "Volatile Crystalline Semiconductor Core Fibers," Materials Science & Technology Technical Meeting and Exhibition (MS&T'23), Columbus, OH, October 2023.
378. K. Chapman, T. W. Hawkins, K. Sardashti, and J. Ballato, "Novel Fibers for Quantum Computing," Materials Science & Technology Technical Meeting and Exhibition (MS&T'23), Columbus, OH, October 2023.
379. D. V. Sampaio, J. C. A. dos Santos, D. C. Silva, J. Ballato, and R. S. Da Silva, "The role of $\text{Eu}^{2+}/\text{Eu}^{3+}$ ratio in Eu^{2+} based persistent phosphors explored by the case of $\text{SrAl}_2\text{O}_4:\text{EuDy}$," Brazilian Materials Research Society (B-MRS), Maceió-Alagoas, Brazil, October 2023.
380. L. Dong, J. Ballato, and J. Kolis, "Revising power scaling limits of diffraction-limited fiber amplifiers," SPIE Photonics West, San Francisco, CA, January 2024.

SECTION VI – ADVISING

Degrees Conferred

1. Russell Esmacher, "Optical Properties of Rare-Earth-Doped Ferroelectric Materials for Tunable Electro-Optic Components," (MS, May 1999), now the **Senior Vice President, IP/Optics Networks - North America** at **Nokia**.
2. Honggu Jiang, "Rare-Earth Doped Phosphate Glass for Nd^{3+} Laser Systems," (MS, May 2000), now **CEO / President** at **NewPion Photonics Technologies** (Shanghai, China).
3. Jonathon James, "Optical Kerr Effect Superlattices," (MS, May 2004), now **Technical Sales - North America** at **Novena Tec**.
4. Jennifer (Thompson) Gordon, "Rare Earth Doped Polymers for Optical Applications," (MS, December 2004), *Funded through a NASA Fellowship*; now a **Project Manager** at **Custom Data Processing** (Lexington, KY).
5. Pradeep Korade Ragavendrarao, "Organic Micro-Ring Lasers on Optical Fibers," (MS, December 2004).
6. Jiwen Liu, "Growth and Characterization of Nitrogen Doped Carbon Nanotubes," (PhD, May 2004), now a **Research Scientist** at **Wake Forest University** and **Technical Leader** at **Ljus, Inc** (Winston Salem, NC)
7. Jeffrey DiMaio, "Photon-Plasmon Coupled Devices for Highly Efficient Optical Filtering and Switching," (PhD, December 2004). *Funded through an NSF Graduate Fellowship*. Now the **CEO** at **Tetramer Technologies**; a COMSET spin-off.
8. Cameron Lobo, "Chalcogenide Hybrid Photonic Crystal Planar Waveguides," (MS, December 2005).
9. Ajoy Saha, "Active Electro-Optic Nanoparticle Composites," (MS, December 2005).
10. Lisa Lu, "Synthesis and Characterization of Rare Earth Doped, Sol-Gel Derived Glasses Containing Nanomaterials," (PhD, August 2005).

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11. Thomas Wade Hawkins, “The Optical and Spectroscopic Properties of Rare Earth Doped Tellurite Glass and Optical Fiber,” (MS, December 2005). Presently **Director of the Optical Fiber Fabrication laboratories at the Clemson University Center for Optical Materials Science and Engineering Technologies (COMSET)**.
12. Karn Serivalsatit, “Fabrication of Transparent Ceramic Laser Media for High Energy Laser Applications,” (PhD, May 2010). Presently a **Professor at Chulalongkorn University** in Thailand.
13. Kyle Gipson, “Production, Properties, and Characterization of Novel Optical Fiber and Amorphous Polymers,” (PhD, August 2011); **co-advised with Professor Phil Brown (MSE)**. Presently an **Associate Professor at James Madison University** (Harrisonburg, VA).
14. Tiffany James, “Spectral Engineering of Optical Fiber through active nanoparticle doping,” (PhD, December 2011). Presently a **Senior Project Engineering at Corning Incorporated** (Wilmington, NC)
15. Stephanie Morris, “Semiconductor Core Optical Fibers,” (PhD, May 2013). Presently a **Senior Scientist at Nufern | Coherent** (East Granby, CT).
16. Alex Evert, “Longitudinally-Refractive Index-Varying Optical Fibers,” (MS, May 2013). Presently a **Fiber Processing Team Facilitator at Corning Incorporated** (Concord, NC)
17. Laura Burka, “Nanoparticle Doped Optical Fibers,” (PhD, May 2014). Presently a **program manager at the U.S. Department of Energy** (Washington DC).
18. Joshua Furtick, “Rare Earth Emissions from polyethylene terephthalate fiber,” (MS, December 2016). Presently a **Process Engineer at Nufern | Coherent** (East Granby, CT).
19. Colin Ryan, “Pockels Coefficients in Multicomponent Oxide Glasses,” (Non-thesis MS degree; May 2017). Presently a **Materials Engineer at the US Naval Air Systems Command** (NAVAIR, China Lake, CA).
20. Maxime Cavillon, “Molten core fabrication of intrinsically low nonlinearity optical fibers,” (PhD, May 2018). Recipient of the **Norbert J. Kreidl Award**, American Ceramic Society (2018), the **Outstanding Graduate Student Award** (College of Engineering, Computing, and Applied Sciences, 2018) and the **Outstanding Graduate Student Award** (Clemson University Graduate School, 2018). Presently a **Professor at the Universite Paris - Saclay** (Paris, France).
21. Benoit Faugas, “Novel bismuth containing optical fibers,” (PhD, May 2018). Presently a **Senior Process Development Engineer at Nufern | Coherent** (East Granby, CT).
22. Amber Vargas, “Nanoparticle doped optical fiber amplifiers and lasers,” MS degree May 2019. Recipient of the **Directed Energy Professional Society (DEPS) Fellowship** (2018, 2019). Presently a **Materials Engineer at the Naval Research Laboratories** (Washington, DC).
23. Matthew Tuggle, “Novel Anderson localizing optical fibers,” (PhD, May 2020). Presently a research scientist for **Corning Incorporated** (Corning, NY).
24. Jason Dobyne, “Glass Science and Engineering: A Literature Review of Significant Research in Structure, Properties, and Mechanical Enhancement” (Non-thesis MS degree; December 2021). Presently Operations Manager at **Nippon Electric Glass** (Lexington, SC).

Current Graduate Advising

1. Bailey Meehan, “Materials science for novel high-power fiber lasers,” PhD degree expected May 2024.
2. Thomasina Zaengle, started PhD program June 2020.
3. Mary Ann Cahoon, started PhD program August 2020.
4. Miranda Stone, started PhD program August 2020.
5. Krissy Chapman, started PhD program June 2022.
6. Peter Wachtel, started PhD program July 2022.

Graduate Committee Member

Have served on the following thesis/dissertation committees at Clemson and for other institutions:

1. Jeffrey Wysocarski, Materials Science and Engineering (Prof. S. Foulger, advisor, MS 1998).

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2. Malin Charoenwongs, Materials Science and Engineering (Prof. R. Schwartz, advisor, MS 1999).
3. Adite Date, Physics and Astronomy (Prof. D. Carroll, advisor, PhD 2001).
4. Sanjay Kotha, Textile Science (Prof. S. Foulger, advisor, MS 2000).
5. Wang Xing, Electrical Engineering (Prof. W. Pearson, advisor, PhD 2001).
6. Thomas Copeland Ceramic Engineering (Prof. B. Lee, advisor, MS 2001).
7. Sirithan Bulpakdi, Materials Science and Engineering (Prof. T. Taylor, advisor, PhD 2002).
8. Prithy Iyer, Physics and Astronomy (Prof. D. Carroll, advisor, PhD 2002).
9. Scott Webster, Physics and Astronomy (Prof. D. Carroll, advisor, PhD 2002).
10. Kyle Brinkman, Materials Science and Engineering (Prof. R. Schwartz, advisor, PhD 2002).
11. David Mesa, Materials Science and Engineering (Prof. R. Schwartz, advisor, MS 2002).
12. James Marra, Ceramic Engineering (Prof. T. Taylor, advisor, PhD 2002).
13. William Nothwang, Materials Science and Engineering (Prof. R. Schwartz, advisor, PhD 2002).
14. Henry Giesber, Chemistry (Prof. J. Kolis, advisor, PhD 2003).
15. Xiaofeng Tang, Materials Science and Engineering (Prof. R. Schwartz, advisor, PhD 2003).
16. Patil Vishwas, Materials Science and Engineering (Prof. S. Foulger, advisor, MS 2003).
17. Gaurang Narasimhan, Textiles, Fiber, and Polymer Science (Prof. S. Foulger, advisor, MS 2003).
18. Kankanige Perera, Chemistry (Prof. D. Smith, advisor, PhD 2004).
19. Navanpan Nisanart, Ceramic Engineering (Prof. R. Schwartz, advisor, PhD 2004).
20. Alfred Forbes, Chemistry (Prof. J. Kolis, advisor, PhD 2004).
21. Manoj Narayanan, Ceramic Engineering (Prof. R. Schwartz, advisor, PhD 2005).
22. Martin Kunz, Ceramic Engineering (Prof. R. Schwartz, advisor, PhD 2005).
23. Amanda Lattam, Textiles, Fiber, and Polymer Science (Prof. S. Foulger, advisor, MS 2005).
24. Gayiti Rehanguli, Electrical Engineering (Prof. W. Pearson, advisor, PhD 2005).
25. Hakan Orak, (Prof. P. Brown, advisor, PhD; did not graduate).
26. Shengron Chen, Chemistry (Prof. D. Smith, advisor, PhD 2005).
27. Jake Jokisaari, Materials Science and Engineering (Prof. S. Bhaduri, advisor, MS 2005).
28. Chris Haines, Ceramic and Materials Engineering, **Rutgers University** (Prof. G. Sigel, advisor, 2005).
29. Yurong Ying, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2006).
30. Ping Jiang, Chemistry (Prof. D. Smith, advisor, PhD 2007).
31. Ankita Roy, Physics (Prof. B. Rafert, advisor, PhD 2008).
32. Seth Stepleton, Chemistry (Prof. J. Kolis, advisor, PhD 2008).
33. Paul Foy, Ceramic and Materials Engineering, **Rutgers University** (Prof. G. Sigel, advisor, 2008).
34. Hanseung Park, Materials Science and Engineering (Prof. J. Luo, advisor, MS 2009).
35. Jonathan Massera, Materials Science and Engineering (Prof. K. Richardson, advisor, PhD 2009).
36. Goo Hwan Shim, Textiles, Fiber, and Polymer Science (Prof. S. Foulger, advisor, PhD 2009).
37. Chris Huebner, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2009).
38. Pengyu Chen, Materials Science and Engineering (Prof. L. Zhu, advisor, MS 2009).
39. Sijie Lin, Polymer and Fiber Science (Prof. P. Ke, advisor, PhD 2009).
40. Ramanaganapathy Kandaswamy, Materials Science and Engineering (Prof. E. Skaar, advisor, MS 2009).

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41. Parul Rungta, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2010).
42. Gayatri Kesar, Materials Science and Engineering (Prof. A. Rao, advisor, PhD 2010).
43. Joel Kohn, Materials Science and Engineering (Prof. P. Brown, advisor, MS 2010).
44. Brett Ellerbrock, Materials Science and Engineering (Prof. P. Brown, advisor, MS 2010).
45. Matt Mann, Chemistry (Prof. J. Kolis, advisor, PhD 2010).
46. Jason Reppert, Materials Science and Engineering (Prof. A. Rao, advisor, PhD 2010).
47. Yafu Lin, Mechanical Engineering (Prof. Y. Huang, advisor, PhD 2010).
48. Esvar Subramanian, Materials Science and Engineering (Prof. A. Rao, advisor, PhD 2011).
49. Ross Economy, Materials Science and Engineering (Prof. M. Kennedy, advisor, MS 2011).
50. Rui Wang, Bioengineering (Prof. B. Gao, advisor, PhD 2011).
51. Jacklyn Wilkinson, Materials Science and Engineering (Prof. K. Richardson, advisor, MS 2012).
52. Alexander Tokarev, Materials Science and Engineering (Prof. K. Kornev, advisor, PhD 2012).
53. Michael Daniele, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2012).
54. Pengyu Chen, Materials Science and Engineering (Prof. L. Zhu, advisor, PhD 2012).
55. Evy Colon-Garcia, Chemistry (Prof. J. Kolis, advisor, MS 2013).
56. Guillaume Guery, Materials Science and Engineering (Prof. K. Richardson, advisor, PhD 2013).
57. Romain Dauliat, XLIM-Département Photonique-Fibre, Faculté des Sciences et Techniques, **Centre National de la Recherche Scientifique (CNRS), Limoges, France** (Prof. Philippe Roy, advisor, PhD 2013).
58. Julia Reid, Materials Science and Engineering (Prof. M. Kennedy, advisor, MS 2013).
59. Yu Gu, Materials Science and Engineering (Prof. K. Kornev, advisor, PhD 2013).
60. David Ross, Materials Science and Engineering (Prof. J. Luo, advisor, PhD 2013).
61. Benn Gleason, Materials Science and Engineering (Prof. K. Richardson, advisor, PhD 2013).
62. Jennifer Graff, Materials Science and Engineering (Prof. T. Tritt, advisor, PhD 2013).
63. Bin Qi, Materials Science and Engineering (Prof. T. Mefford, advisor, PhD 2013).
64. Aaron Pung, Photonic Science and Technology (Prof. E. Johnson, advisor, PhD 2013).
65. Arash Mehdizadeh, Materials Science and Engineering (Prof. T. Tritt, advisor, PhD 2014).
66. Do-Yeob Kim, Electrical and Computer Engineering (Prof. S-O. Kim, advisor, PhD 2014).
67. Ross Economy, Materials Science and Engineering (Prof. M. Kennedy, advisor, PhD, 2015).
68. Matthew Chapman, Materials Science and Engineering (Prof. Jacobsohn, advisor, MS, 2015).
69. Mehmet Karakaya, Physics (Prof. A. Rao, advisor, PhD 2016).
70. Yunsong Zhao, Electrical Engineering (Prof. L. Zhu, advisor, PhD 2016).
71. Cherie Moore, Chemistry (Prof. J. Kolis, advisor, PhD 2016).
72. Chenguang Huang, Electrical and Computer Engineering (Prof. L. Zhu, advisor, PhD 2016).
73. Guancheng Gu, Photonic Science and Technology (Prof. L. Dong, advisor, PhD 2016).
74. Yuan Li, Photonic Science and Technology (Prof. E. Johnson, advisor, PhD 2016).
75. Matthew Kielty, Materials Science and Engineering (Prof. Jacobsohn, advisor, MS, 2016).
76. Sajad Ghatreh Samani, **Macquarie University, Australia** (Prof. Graham Town, advisor, Department of Engineering, PhD 2016); external reviewer.
77. Jie Huang, Electrical and Computer Engineering (Prof. Hai Xiao, advisor, PhD 2017).

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78. Christopher Dunn, Photonic Science and Technology (Prof. L. Dong, advisor, MS 2017).
79. Indumathi Raghu, Photonic Science and Technology (Prof. E. Johnson, advisor, PhD 2017).
80. Lei Yuan, Electrical and Computer Engineering (Prof. Hai Xiao, advisor, PhD 2017).
81. Jie Liu, Electrical and Computer Engineering (Prof. Hai Xiao, advisor, PhD 2017).
82. Ryan Roeder, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2018).
83. Bipin Sharma, Physics and Astronomy (Prof. Apparao Rao, advisor, PhD 2019).
84. Silje Svendsen, **Norwegian University of Science and Technology, Norway** (Prof. Ursula Gibson, advisor, Department of Physics, MS, 2017).
85. Kristin Lønsethagen, **Norwegian University of Science and Technology, Norway** (Prof. Ursula Gibson, advisor, Department of Physics, MS, 2017).
86. Vilde Sømnes, **Norwegian University of Science and Technology, Norway** (Prof. Ursula Gibson, advisor, Department of Physics, MS, 2017).
87. Seunghan Song, **Norwegian University of Science and Technology, Norway** (Prof. Ursula Gibson, advisor, Department of Physics, MS, 2017).
88. Juliano Hayashi, **University of Sydney, Australia** (Prof. Simon Fleming, advisor, Department of Physics, PhD 2018); external reviewer.
89. Anita Kumari, **Indian Institute of Technology (Indian School of Mines) Dhanbad** (PhD, 2018); external examiner.
90. Yeyu Zhu, Electrical and Computer Engineering (Prof. Lin Zhu, advisor, PhD 2019).
91. Michael Fried, **Norwegian University of Science and Technology, Norway** (Prof. Ursula Gibson, advisor, Department of Physics, MS, 2019); external reviewer.
92. Thomas Hawkins, Materials Science and Engineering (Prof. Liang Dong, advisor, PhD 2020).
93. Eric Zhang, Materials Science and Engineering (Prof. S. Foulger, advisor, PhD 2020).
94. Turghun Matniyaz, Photonic Science and Technology (Prof. Liang Dong, advisor, PhD 2020).
95. Siwei Zeng, Electrical and Computer Engineering (Prof. Lin Zhu, advisor, PhD 2021).
96. Yedidya Lior, **The Hebrew University of Jerusalem, Israel** (Prof. Dan Maron, advisor, Department of Applied Physics, PhD 2021); external reviewer.
97. Lance Alexander Sweatt, Electrical and Computer Engineering (Prof. Lin Zhu, advisor, PhD 2023).
98. Nanjie Yu, **University of Illinois at Urbana-Champaign** (Prof. Peter Dragic, advisor, Department of Electrical and Computer Engineering, PhD, 2022); external reviewer.
99. Zhuorui Lu, **Université Côte d'Azur, Nice, France** (Prof. Wilfried Blanc, advisor, PhD 2022); external reviewer.
100. Cody Bassett, **University of New Mexico** (Prof. Arash Mafi, advisor, Department of Physics, PhD, 2022); external reviewer.
101. Zhannat Ashikbayeva, **Nazarbayev University, Kazakhstan** (Daniele Tosi, advisor, Department of Materials Science, PhD 2022); external reviewer.
102. Matthew Page, Materials Science and Engineering (Prof. Ming Tang, advisor, PhD 2022).
103. Amit Kumar, **National Institute of Technology – Kurukshetra, Haryana, India**, Electronics and Communication Engineering (Prof. Pankaj Verma, advisor, PhD 2023); external reviewer.
104. Tyler LeVaur, Electrical and Computer Engineering (Prof. Lin Zhu, advisor, PhD 2023).
105. Xiaolei Zhao, Photonic Science and Technology (Prof. Lin Zhu, advisor, PhD 2023).
106. Allen Benton, Physics and Astronomy, (Prof. Apparao Rao, advisor, PhD 2023).
107. Mark Mihalik, Electrical and Computer Engineering (Prof. Liang Dong, advisor, MS expected 2024).

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Post-Doctoral / Research Associate Mentoring

1. Dr. Pingxiong Yang, “Pulsed laser deposition of electro-optic thin film superlattices,” (2000 – 2003).
2. Dr. Sihai Chen, “Synthesis and optical properties of Ag nanoparticles,” (2003 – 2004).
3. Dr. Jeffrey DiMaio, Research Assistant Professor, “Active Nanoparticles and Optical Composites,” (2005 – 2007).
4. Dr. Paul Foy, Director, Optical Fiber Fabrication Laboratories (2005 – 2012).
5. Thomas Hawkins, Optical fiber draw laboratory (2005 – 2020).
6. Andrew James, Optical fiber lathe laboratory (2006 – 2011).
7. Baris Kokuoz, Active nanoparticles and transparent ceramics research (2006 – 2009).
8. Basak Kokuoz, Active nanoparticles and transparent ceramics research (2007 – 2009).
9. Dr. Luiz Jacobsohn, Active nanoparticles for sensing applications (2009 – 2013).
10. Courtney Kucera, Active nanoparticles and transparent ceramics (2009 - 2020).
11. Dr. Artem Trofimov, Low nonlinearity optical fibers (2018).
12. Baris Kokuoz, Semiconductor optical fiber research (2018 – present).
13. Dr. Maxime Cavillon, Intrinsically low nonlinearities optical fibers (2018 – 2020).
14. Dr. Matt Tuggle, Novel optical fibers (2020).
15. Dr. Thomas Hawkins, Directory, Optical fiber Fabrication Laboratory (2020 – present).

Undergraduate Students – Research Advising

1. Andrew James, Photonic Bandgap Structures (1997 – 1998).
2. Jeff DiMaio, Photonic Bandgap Structures (1998 – 2000).
3. Suzette Rhyne, Nanoparticle synthesis (2000 – 2002).
4. Courtney Kucera, Active Nanoparticles and Transparent Ceramics (2006 – 2009).
5. Axley McCormick, Active Nanoparticles and Transparent Ceramics (2007 – 2009) and undergraduate senior thesis (BioEngineering; 2009).
6. Dale Edmondson, MCVD and Optical Fiber Preform Fabrication (2007 – 2009).
7. Scott Anstey, Active Nanoparticles and Transparent Ceramics (2008 – 2009).
8. Alex Evert, MCVD and Optical Fiber Preform Fabrication (2009 – 2010).
9. Kevin Sprinkle, Active Nanoparticles and Transparent Ceramics (2009 – 2010).
10. Steven Roberts, Active Nanoparticles and Transparent Ceramics (2009 – 2012).
11. Erin Garber, Active Nanoparticles and Transparent Ceramics (2009 – 2010).
12. Joshua Furtick, Senior Honors Thesis, Materials Science and Engineering, 2012.
13. Michael Berry, Senior Honors Thesis, Mechanical Engineering, 2013.
14. Mitchell Fanning, Senior Honors Thesis, Materials Science and Engineering, 2014.
15. Matt Tuggle, Active Nanoparticles and Optical Fibers (2014 – 2017). Recipient of the **Alfred R. Cooper Award** for outstanding undergraduate glass science research (American Ceramic Society 2016).
16. Seth Russell, Low loss barosilicate optical fibers, Senior Research Thesis, Materials Science and Engineering, 2016.
17. Dakota Sligh, Transition metal doped optical fibers, Senior Research Thesis, Materials Science and Engineering, 2016.

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18. Jonathon Drake, Senior Honors Thesis, Materials Science and Engineering, 2016-2018. Recipient of the **J. Wesley Davis Leadership Award** from the College of Engineering (2018).
19. Walter Brackin, Senior Research Thesis, Materials Science and Engineering, 2017-2018.
20. Michael Kucia, Senior Research Thesis, Materials Science and Engineering, 2017-2018.
21. Jane Gragg, Senior Research Thesis, Materials Science and Engineering, 2017-2018.
22. Katherine (Katie) Morgan, Senior Research Thesis, Materials Science and Engineering, 2018-2019.
23. Bailey Meehan, Undergraduate Research (MSE 4910), Materials Science and Engineering, 2018-2019.
24. Erin McLaughlin, Senior Research Thesis, Materials Science and Engineering, 2018-2019.
25. Nicholas Medley, Senior Research Thesis, Materials Science and Engineering, 2018-2019.
26. Rebecca Woodall, Undergraduate Research, Materials Science and Engineering, 2018-2020.
27. Robert Gruskos, Senior Research Thesis, Materials Science and Engineering, 2019-2020.

Undergraduate Students – Professional Advising

1. Class of 2019: Austin Richardson and Casey Wilson.
2. Class of 2020: Robert Hawsey, Vincent Phaneuf, and Joshua Toney.
3. Class of 2021: Mary Beth Fulton and Mia Maciorowski.
4. Class of 2022: Trey Alpi, Ben Kredensor.
5. Class of 2023: August Brueggermann
6. Class of 2024: Rylee Rollins, Jack Hoffler, David Lyttle, Ian Aukamp

Summer Students

1. Benjamin Garrett, SC Governor's School for Math and Science, Hartsville, SC, Summer 2003
2. Nathan Bessette, Summerville High School, Charleston, SC, Summer 2004
3. Patrick Mittelstadt, Wando High School, Charleston, SC, Summer 2005
4. Clement Sabatier, École Nationale Supérieure de Physique de Strasbourg, Summer 2005. **Summer student through a National Science Foundation International REU program.**
5. Giovanna Tyler, Aiken High School, Aiken, SC, Summer 2006. **Summer student through CAEFF REU program.**
6. Tyler Ruggles, Colorado College, Summer 2006. **Summer student through CAEFF REU program.**
7. **"Townes Fellows" through COMSET initiative with Furman University dedicated to Dr. Charles Townes (jointly with Profs. Stephen Foulger and Phil Brown):**
 - Summer 2006: Duke West.
 - Summer 2007: Michael Miller, Brian Stevenson, and David Gries.
 - Summer 2008: David Gries and Ashley Anderson.
 - Summer 2009: Matthew Goodson and Emily Chasteen.
 - Summer 2010: Catie Crain, Derek Stether, Dustin Balentine, and David Weigel.
 - Summer 2011: Joel Bloom, Luke Maloney, David Hathaway and Nick Jenkins.
 - Summer 2012: Caitlin Stanton, John Guerrier, Will Smith, David Hanor, Matt Tyson.
 - Summer 2013: Joshua Richmond and Thomas Richardson.
 - Summer 2014: Sarah Gauby, Vincent Dowling, Michelle Greenough.
 - Summer 2015: Lauren Pinion, Brooks Musangu, and Garret Brown.
 - Summer 2016: Amber Vargas, Matthew Quarles, and Rebecca Woodall.

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- Summer 2017: Thomas Trankle, Cameron Gronines, and Megan Cavrak.
- Summer 2018: Kiersten Nalani Brown, Zachary Masner, Sean Davis, Curtis Adams.
- Summer 2019: Rebecca Woodall, Emily Woodall, Sarah-Margaret Andrews, Neal Yates, Max Fisher, Eric Foxwell

Visiting Scholars / Students

- Prof. Sergei Pyshkin, Moldovan Academy of Sciences, “GaP Nanoparticles,” (2005 – 2006). **Fulbright Scholar from Moldova**
- Maxime Cavillon, University of Burgundy, France; 6 months Master’s Degree internship (2013).
- David Sampaio, Federal University of Sergipe - Brazil (2014 – 2015); now a **Professor at University in Maceió, Alagoas, Brazil.**
- Prof. Ronaldo Santos da Silva, Department of Physics, Universidade Federal de Sergipe (Aracaju, Sergipe, Brazil), Sabbatical (2017 – 2018).
- Prof. Ursula Gibson, Department of Physics, Norwegian University of Science and Technology (NTNU, Trondheim, Norway), Sabbatical (2018 – 2019; while Prof. Gibson is President-elect of the Optical Society of America, OSA).
- Prof. Magnus Engholm, Department of Electronics Design, Mid-Sweden University, Sabbatical (2019).

Advisor

- Clemson student chapter of the American Ceramic Society (1998 – 2005); **Chapter named “Best Chapter” in country (1999, 2000, 2001).**
- Clemson student chapter of the International Society of Optical Engineering (SPIE); (2012 – 2017).

Courses Taught (Clemson University; over 1,000 students cumulatively taught to date)

- *CME / MSE 2100, Introduction to Materials Science, F97, S98, F98, S99, F01, F20, F21*
 - Introductory course in materials science designed primarily for engineering students. Study of the relation between the electrical, mechanical, and thermal properties of products and the structure and composition of these products. All levels of structure are considered from gross structures easily visible to the eye through electronic structure of atoms.
- *CME 4020/6020, Solid State Ceramics, F99, S00, F05, F06, F07*
 - Discussion of the properties of solids as related to structure and bonding with emphasis on electronic materials. Band structure theory, electronic, and optical properties are treated.
- *MSE 8190, Inorganic Materials Characterization Techniques and Laboratory, F22*
 - Presents the fundamentals, applications and limitations of selected analytical techniques used to characterize the structure, chemical composition, chemical bonding, chemical state and morphology (imaging) of inorganic solid materials.
- *MSE 4130/6130, Non-Crystalline Solids, F13*
 - An introduction to the fundamentals of the glassy state including the role of thermodynamics and kinetics in the glass formation process and the effect of the glass chemistry/constituents on the resulting glass structure and corresponding physical properties that impact ultimate applications.
- *CME 4240/6240, Properties of Optical Ceramics, S98, S00, S01, S02, F02, F03, S04, S05, S06, S07, S08, S09, S10, S11, S12, S13, S14*
 - Introduces the interaction of materials with light. Specific topics include fundamental optical properties, materials synthesis, optical fiber and planar waveguides, and the componentry and systems-level aspects of optical communication systems.
- *MSE 4070, Senior Capstone Design, F15, S16, F16, S17, F17, S18, F18, S19, F19, S20*

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- Develop a sustainable business concept relating to materials-related processes or product development. Course will emphasize inter-disciplinary team approaches and global perspectives to products and problems. Incorporates critical thinking, group effectiveness, and problem solving with materials and processes.
- *CME 8210, Analytical Procedures and Equipment I, F98*
 - Familiarizes students with the fundamental physical principles and operative procedures of x-ray diffraction analysis and related analytical techniques.
- *CME 8210L, Analytical Procedures and Equipment Laboratory, F98*
 - Familiarizes students with the operative procedures of x-ray diffraction as a qualitative and quantitative analysis tool
- *CME / MSE 8900, Special Topics in Advanced Optical Materials, F00, F01, S03, S22*
 - To provide students with an advanced understanding of materials and devices in modern optical communication systems.
- *ENGR 1500, Introduction to Materials, F99*
 - Introduction to materials used in modern technology. Different materials (metals, ceramics, and polymers) and different forms (bulk, fibers, gels, thin films, etc.) are discussed in the context of their application to consumer products, structural composites, refractories, biomedical implants, and electronic and optical materials.
- *ENGR 1010, Introduction to Engineering, F00, F01*
 - Introduction to the engineering profession and engineering disciplines for the purpose of assisting students in their selection of engineering major. Professional ethics, technical communications, word processing, and electronic communications are taught.

Student evaluations from these courses have always been among the highest in the College. Section 1 also notes the *Byar's Prize for Excellence in Teaching* received for these activities.

SECTION VII – PROFESSIONAL SERVICE AND ECONOMIC DEVELOPMENT ACTIVITIES

Advisory Boards / Committees

1. InnoVenture (2004 – 2010).
2. Center for Optoelectronics and Optical Communications, University of North Carolina at Charlotte (2005 – 2010).
3. Economic Development Alliance of Pickens County (“Alliance Pickens”; 2007 – 2011, Clemson University Representative; President Barker’s appointee); Alliance Pickens is the economic development organization for Pickens County, SC.
4. Innovate Anderson (2008 – 2011); Innovate Anderson is the economic development marketing organization supporting Anderson County, SC.
5. Center for US Japan Alliance with Clemson (2008 – 2011).
6. Workforce Training and Educational Services Task Force of the State Higher Education Plan, South Carolina Commission on Higher Education (2008 – 2009).
7. Anderson County Economic Development (2009 – 2011, Clemson University Representative; President Barker’s appointee); Anderson County Economic Development is the economic development organization for Anderson County, SC.
8. Przirembel Prize (2010 – 2015), InnoVenture.
9. Upstate SC Alliance, (2014 – 2015); Board of Directors.

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10. Charleston Regional Development Alliance, CRDA (2014 – 2015); Board of Directors.
11. NEXT Innovation Center, Greenville (2015 – 2017); Board of Directors.

Expert Witness / Consulting Service

Have served as an expert in legal cases corporate acquisitions for the following companies:

- VitroCom / JDS-Uniphase (2000 – 2001)
 - Provided expert report on trade secrets associated with optical fiber fabrication processing. Worked with JDSU in-house counsel and lawyers from Topkins, McGuire, Wachenfeld, and Barry (Newark, NJ).
- Lang Mekra North America (2005 – 2006)
 - Provided expert report on a series of patents in a patent infringement litigation ultimately settled out of court. Worked with McNair Law Firm (Greenville, SC).
- Clear View Vision Armor, LLC (2007)
 - Civil Action No. 3:07cv00221 handled by the Charlotte Division of the US District Court for the Western District of North Carolina in the case involving Racing Optics, Inc. versus Clear View Racing Optics, LLC. Served as an expert witness in support of the defendants (Clear View). Provided several reports after reviewing the relevant patents as well as two declarations. Also testified in court; case ultimately was settled prior to the judge's decision. Worked with Summa, Allan & Additon (Charlotte, NC).
- Baker Hughes (2011 – 2012)
 - Provided expert witness testimony on trade secret litigation associated with optical fiber fabrication: *Baker Hughes Incorporated, et al. v. Daniel S. Homa, et al.* U.S. District Court, Southern District of Texas, Houston Division Civil Action No. 4:11-cv-03757. Worked with Fulbright & Jaworski (Houston, TX).
- LG Electronics (2011 – 2012)
 - International Trade Commission (ITC) investigation numbers 337-TA-784, 337-TA-785 and District Court Case 3:11-cv-02699-MEJ. Expert for LG Electronics in case adverse to Osram relating to light emitting materials and structures associated with display technologies. Provided expert reports and witness statements on both non-infringement and domestic industry. Was deposed and testified at trial. Worked with Finnegan Henderson (Counsel from Washington DC and Boston, MA offices).
- Samsung (2012)
 - International Trade Commission (ITC) investigation number 337-TA-785. Expert for Samsung in case adverse to Osram relating to light emitting materials and structures associated with display technologies. Provided domestic industry expert report and witness statements. Was deposed and testified at trial. Worked with Covington & Burling (Counsel from Washington, DC and Redwood Shores, CA offices).
- OFS-Fitel (2017 – 2018)
 - International Trade Commission (ITC) investigation number 337-TA-1031. Expert for OFS-Fitel in case adverse to DSM Desotech relating to optical fiber coatings and related fiber products. Provided expert and rebuttal reports relating to non-infringement and invalidity. Was deposed and testified at trial. Worked with Barnes & Thornburg (Counsel from Washington, DC office).
- IKEA (2020 – 2021)
 - International Trade Commission (ITC) investigation number 337-TA-1220. Expert for IKEA (and occasionally including General Electric Company, Home Depot, Satco Products, Global Value Lighting, and Signify) in case adverse The Regents of the University of California relating to "Certain filament light-emitting diodes and products containing same (II)." Provided declaration and expertise, and was

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deposed, relating to transparent ceramics. Worked with Flaster Greenberg PC (Counsel from Philadelphia, PA office).

- Hengtong (2020 – 2021; on-hold due to COVID, then settled)
 - Provided expert witness services on litigation associated with optical fiber fabrication in the matter *Sterlite Technologies Limited vs Hengtong Optic - Electric India* before the Delhi High Court, India. Worked with King & Wood Mallesons (Counsel from Beijing and Mumbai offices).
- Tech DNA (2022)
 - Confirmatory technical and manufacturing due diligence for the [acquisition of Lumenisity, the world's leading provider of hollow core optical fibers, by Microsoft](#).
- Hebei Huatong Wires and Cables Group (2023)
 - Provided declaration and expert services for a petition for *inter partes* review (IPR). Worked with K&L Gates (Counsel from Chicago, IL office).

Professional Service

External Advisory Board	Department of Materials Science and Engineering, Rutgers University (2021 – present).
Editorial Board	<i>Journal of Optical Communications</i> (2008 – present).
Editorial Board	<i>Annals of Materials Science & Engineering</i> (2014 – present).
Editorial Board	<i>Frontiers in Materials</i> , Glass Science section (2014 – present). <i>Frontiers in Photonics</i> , Light Sources and Luminescent Materials (2021 – present).
Editor	<i>Optical Materials</i> (Elsevier, 2018 – present).
Associate Editor	<i>Optical Materials</i> (Elsevier, 2017 – 2018). <i>Optics Letters</i> (Optical Society of America, 2011 – 2017). <i>Journal of the American Ceramic Society</i> (American Ceramic Society, 2003 – 2017).
Member	American Ceramic Society (ACerS, since 1990; Fellow 2009). Optical Society of America (OSA, since 1993; Senior Member 2010; Fellow 2012). International Society for Optical Engineering (SPIE, since 1995; Fellow 2011). Institute of Electrical and Electronics Engineers (IEEE); IEEE Photonics Society (UFFC Society 1997 – 2001 and Photonics Society 2011 – present; Senior Member 2012; Fellow 2017). American Association for the Advancement of Science (AAAS, 2011 – present; Fellow 2019). American Physical Society (APS; 2014 – present; Fellow 2020). Directed Energy Professional Society (DEPS; 2013 – present). <i>Aspen Global Leadership Network</i> (AGLN, 2007 – present). The AGLN is a global network of leaders who have gone through one of the Aspen Institute leadership initiatives.
Executive Committee	Glass and Optical Materials Division of the American Ceramic Society: Secretary (2009), Vice Chair (2010), Chair-Elect (2011), Chair (2012).
Committee Chair	Optical Society of America, Optics in the Southeast Conference (2006); Chair-Elect (2005). Program Committee, Glass and Optical Materials Division, American Ceramic Society (2007-2008).

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Robert L. Coble Award Selection Committee, *American Ceramic Society* (2008 – 2009).

Norbert Kreidl Award Committee, *American Ceramic Society* (2013 – 2014).

Varshneya Frontiers of Glass Lectures Committee, *American Ceramic Society* (2016 – 2019).

Education and Professional Development Council, *American Ceramic Society* (2018); responsible for the Karl Schwartzwalder Professional Achievement in Ceramic Engineering Award, the Greaves-Walker Award, and the Arthur L. Friedberg and Outstanding Educator Award.

Committee Member U.S. Council on Competitiveness, U.S. Energy & Manufacturing Competitiveness Partnership, Advisory Committee (2014 – 2016).

Technical Committee 20, “Photonic Glasses and Optical Fibers,” *International Commission on Glass* (ICG, 2001 – present).

Awards and Scholarships Committee, Electronics Division, *American Ceramic Society* (2000-2001).

Optical Materials Technology Working Group, Military Critical Technologies List; MCTL (2008 – present).

Ferroelectrics Standards Committee, *IEEE-UFFC Society* (1998 – 2005)

Robert L. Coble Award Committee, *American Ceramic Society* (2004 – 2009); Chair (2009).

Norbert Kreidl Award Committee, *American Ceramic Society* (2009 – 2012).

Publications Committee, *American Ceramic Society* (2008 – 2012; Chair 2011 - 2012).

Publications Committee, *International Society of Optical Engineering* (SPIE; 2010 – 2014).

Society Awards Committee, *American Ceramic Society* (2010-2012; Chair 2011).

Strategic Planning for Emerging Opportunities Committee, *American Ceramic Society* (2011 - 2012).

Spotlight on Optics, Optical Society of America (2012 – present).

National Photonics Initiative, The National Research Council of The National Academies of the United States, Sub-Committee on Photonics in Energy (2013 – 2015).

Committee for the selection of the Karl Schwartzwalder-Professional Achievement in Ceramic Engineering (PACE) Award, *National Institute of Ceramic Engineering* (2013 – 2018).

“Faculty of the Year” Award Selection Committee, School of Engineering, Rutgers University (2014 – present).

Meetings Council, *Optical Society of America* (2016 – 2018 term).

Functional Glass Manufacturing Innovation Consortium, American Ceramic Society (2016 – 2018).

SWOT (Strengths, Weakness, Opportunities, and Treats) Working Group, Optical Society of America (2016 – 2018).

President’s Award Selection Committee, International Commission on Glass (2016).

Expert Panel on Novel Fiber Laser Technology, EO&P Division, US Army Research Laboratory (2017).

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Committee for the selection of the Alfred R. Cooper Young Scholars Award, *American Ceramic Society* (2019 – present; Chair 2020).

Technical Council Evaluator, IEEE Photonics Society (2020 – 2022).

Rishi Raj Medal for Innovation and Commercialization Award Committee, American Ceramic Society (2021 – 2026).

SC Governor's Awards for Excellence in Science Selection Committee, South Carolina Academy of Sciences (2022).

UN International Year of Glass 2022

US Subgroup of the International Steering Committee for the *2022 International Year of Glass* (IYoG, 2019 – present).

Moderator, "Seeing the Future Through Glass" panel, *National Day of Glass*, Washington, DC, 5 – 7 April 2022.

Contributing author and editor to numerous IYOG 2022 special journal issues and books (see Sections III), including:

- "Celebrating Optical Glass: The International Year of Glass 2022," Optical Materials Express Feature Issue, Kathleen Richardson (USA, Lead Editor), John Ballato (USA), Ulrich Fotheringham (Germany), Mathieu Hubert (USA), Stefan Nolte (Germany), and Laetitia Petit (Finland).

Conference Chair

Optical Society of America

"Optics in the Southeast" Conference (2001)

American Ceramic Society

Glass and Optical Materials Division Program Chair (2004)

3rd International Conference on Ceramics, Osaka, Japan, November 2010.

Specialty Optical Fibers Conference, OSA Advanced Photonics 2011 Congress, Toronto, Canada (2011).

Symposium on Specialty Optical Fiber, OSA Optical Fiber Communication Conference (OFC), 2011.

Specialty Optical Fibers Conference, OSA Advanced Photonics Congress, Colorado Springs, Colorado (2013).

Specialty Optical Fibers Conference, OSA Advanced Photonics Congress, Barcelona, Spain (2014).

Steering Committee, International Workshop on Photoluminescence in Rare Earths: Photonic Materials and Devices (PRE, 2013 – present).

Fiber Lasers XII: Technology, Systems, and Applications, SPIE Photonics West Conference, San Francisco, CA, February 2015; Chair-elect.

Fiber Lasers XIII: Technology, Systems, and Applications, SPIE Photonics West Conference, San Francisco, CA, February 2016; Chair.

Specialty Optical Fibers Conference, OSA Advanced Photonics Congress, Vancouver, Canada, July 2016.

Joint meeting of the Glass and Optical Materials Division of the American Ceramic Society and the Glass and Photonics Materials Division meeting of the Japanese Ceramic Society, Kyoto, Japan, November 2016 (Conference co-chair with Prof. Setsu Tanabe).

Photonics West LASE Conference (2017), Laser Sources Track (2016 – 2017).

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Symposium Co-chair for Fiber-Based Technologies and Applications, Joint 12th Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR 2017), 22nd OptoElectronics and Communications Conference (OECC 2017), and 5th Photonics Global Conference 2017 (PGC 2017), Singapore, July 2017.

6th Workshop on Specialty Optical Fibers and Their Applications (WSOF2019), Charleston, SC, 2019.

Chair, Photonics West LASE Conference (2021-2024),

Conference / Program Organization

Optics in the Southeast Conference, Optical Society of America (2000 – 2006)

Photonic Materials, Components and Applications, Glass and Optical Materials Division, American Ceramic Society Annual Meeting, St. Louis, MO, May 2000.

Fiber Optics and Optical Communication Technologies, Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging, Joint OSA/SPIE, Charlotte, NC, September 2000.

Fiber Optics and Optical Communication Technologies, OSA Optics in the Southeast Conference, Clemson, SC, October 2001.

Optical Materials for Photonics Technologies, American Ceramic Society PAC RIM IV Conference, Maui, HI, November 2001.

Symposium on Photonics, Networking and Computing, 6th Joint Conference on Information Sciences (JCIS 2002), Research Triangle Park, NC, March 2002.

Nanostructured Materials for Photonics, Glass and Optical Materials Division, American Ceramic Society, Pittsburgh, PA, October 2002.

Optical Science and Materials, OSA Optics in the Southeast Conference, Huntsville, AL, October 2002.

Photonics and Opto-Electronics, American Ceramic Society Annual Meeting, Nashville, TN, May 2003.

Linear and Nonlinear Optics of Organic Material III, SPIE Annual Meeting, San Diego, CA, August 2003.

Symposium on Photonics, Networking and Computing, 7th Joint Conference on Information Sciences (JCIS 2003), Cary, NC, September 2003.

Quantum Sensing, Nanophotonic Devices, SPIE Photonics West Conference, San Jose, CA, January 2004.

Linear and Nonlinear Optics of Organic Material IV, SPIE Annual Meeting, Denver, CO, August 2004.

Nonoxide and Novel Optical Glass Conference, Cape Canaveral, FL, October 2004.

Glass and Optical Materials Division Meeting, American Ceramic Society, Cape Canaveral, FL, October 2004.

Optical Science and Materials, OSA Optics in the Southeast Conference, Charlotte, NC, November 2004.

Optical Components and Materials II, SPIE Photonics West Conference, San Jose, CA, January 2005.

Quantum Sensing and Nanophotonic Devices, SPIE Photonics West Conference, San Jose, CA, January 2005.

Glass and Optical Materials Division Meeting, American Ceramic Society, Greenville, SC, April 2005.

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Micro and Nano Photonics, OSA Photonics Research and Applications, San Diego, CA, April 2005.

Symposium on Photonics, Networking and Computing, 8th Joint Conference on Information Sciences (JCIS 2005), Salt Lake City, UT, July 2005.

Micromachining Technology for Micro-Optics and Nano-Optics IV, SPIE Symposium on MOEMS-MEMS 2006, San Jose, CA January 2006.

Nanophotonics / Integrated Photonics Research and Their Application (IPRA) Topical Meeting, Optical Society of America, Uncasville, CT, April 2006.

Optically Active Materials, Glass and Optical Materials Division, American Ceramic Society, Greenville, SC, May 2006.

Novel Glass and Optical Materials Compositions, Glass and Optical Materials Division, American Ceramic Society, Greenville, SC, May 2006.

Optical Science and Materials, OSA/SPIE Optics in the Southeast Conference, Charlotte, NC, September 2006.

International Conference on Photonics, Networking, and Computing, Taiwan, October 2006.

Micromachining Technology for Micro-Optics and Nano-Optics V, SPIE Symposium on MOEMS-MEMS 2007, San Jose, CA January 2007.

Glass and Optical Materials Division Meeting, American Ceramic Society, Rochester, NY, May 2007.

Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE '07), Trento, Italy, May 2007.

Optically Active Materials, Glass and Optical Materials Division, American Ceramic Society, Rochester, NY, May 2007.

MS&T Glass and Optical Materials Division Conference, Detroit, MI September 2007.

Photonic and Optoelectronic Materials, Southeast Regional Meeting of the American Chemical Society (SERMACs), Greenville, SC, October 2007.

Advanced Fabrication Technologies for Micro/Nano-Optics & Photonics (MF06), SPIE Photonics West Conference, San Jose, CA, January 2008.

Advanced Fabrication Technologies for Micro/Nano Optics and Photonics II (MF106), SPIE Photonics West Conference, San Jose, CA, January 2009.

Glasses for Optoelectronics and Optical Applications, International Commission on Glass/Glass and Optical Materials Division of the American Ceramic Society Symposia at the 8th Pacific Rim Conference on Ceramics and Glass Technology, Vancouver, BC, Canada, June 2009.

Advanced Fabrication Technologies for Micro/Nano Optics and Photonics III (MF106) SPIE Photonics West Conference, San Francisco, CA, January 2010.

Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE '10), Florence, Italy, April 2010.

Nonlinear Photonics (NP), OSA Optics & Photonics Congress and Exhibit, Karlsruhe, Germany, June 2010.

Fourth International Conference on Optical, Optoelectronic and Photonic Materials and Applications (ICOOPMA), Budapest, Hungary, August 2010.

2nd Specialty Optical Fibers Workshop, Oaxaca, Mexico, October 2010.

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Fiber Lasers VIII: Technology, Systems, and Applications, (LA103) SPIE Photonics West Conference, San Francisco, CA, January 2011.

Advances in Optical Materials (AIOM) Conference at the Lasers, Sources, and Related Photonic Devices Congress, Istanbul, Turkey, February 2011.

3rd Asia-Pacific Optical Sensors Conference (APOS2012), Sydney, Australia, January 2012.

Fiber Lasers IX: Technology, Systems, and Applications, SPIE Photonics West Conference, San Francisco, CA, January 2012; Chair for *Fiber Designs and Fabrication*.

Optical Fibres for Sensing (chair of technical program sub-committee), 3rd Asia Pacific Optical Sensors Conference 2012 (APOS 2012), Sydney, Australia, February 2012.

Advances in Optical Materials (AIOM) Conference at the Optical Society of America Optics and Photonics Congress, San Diego, CA, February 2012.

Micro-structured and Specialty Optical Fibres Conference, Photonics Europe 2012, Brussels, Belgium, April 2012.

Novel Nonlinear Materials subcommittee, Nonlinear Photonics 2012, OSA topical Advanced Photonics Congress, Colorado Springs, June 2012.

Fiber Lasers X: Technology, Systems, and Applications, SPIE Photonics West Conference, San Francisco, CA, February 2013; Chair for *Fiber Designs and Fabrication* subcommittee; Member of *Visible and UV Lasers* Subcommittee.

Micro-structured and Specialty Optical Fibres (EOO106), Prague, April 2013.

Glasses for Optoelectronic and Optical Applications, International Commission on Glass / Glass and Optical Materials Division of the American Ceramic Society, PACRIM 10, San Diego, CA, June 2013.

International Conference on Transparent Optical Networks - ICTON 2013; Special sessions on “Nanophotonics and smart optical nanostructures” and “Sub-wavelength photonic devices,” Cartagena, Spain, June 2013.

15th IUPAC International Symposium on MacroMolecular Complexes, Greenville, SC, August 2013.

3rd Specialty Optical Fibers Workshop, Stockholm, Sweden, September 2013.

Optical Society of America’s Frontiers in Optics (FiO), Fiber Optics and Optical Communications Symposium, Orlando, FL, October 2013.

Advances in Optical Materials (AIOM) Conference at the Advanced Solid-State Lasers (ASSL) OSA Congress, Paris, France, October 2013.

Co-Chair of the Sub-committee on Novel Fibers and Fiber-based Devices (SC 2) of Asia Communications and Photonics Conference and Exhibition (ACP) 2013, Beijing, China, November 2013.

Fiber Lasers XI: Technology, Systems, and Applications, SPIE Photonics West Conference, San Francisco, CA, February 2014.

5th International Workshop on Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE’14), San Sebastián, Spain, May 2014.

International Advisory Board for the “Inorganic Materials Systems for Optical and Photonic Applications” Symposium of the 13th International Ceramics Congress, Montecatini Terme, Tuscany, Italy, June 2014.

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Novel Nonlinear Materials subcommittee, Nonlinear Photonics 2012, OSA topical Advanced Photonics Congress, Barcelona, Spain, July 2014.

Frontiers in Optics (FiO), Fiber Optics and Optical Communications Symposium, Optical Society of America, Tucson, AZ, October 2014.

Novel Optical Materials and Applications (NOMA), Optical Society of America, Boston, MA, June 2015.

Optical Society of America's Frontiers in Optics (FiO), Fiber Optics and Optical Communications Symposium, Tucson, AZ, October 2015.

4th Workshop on Specialty Optical fibers (WSOF'2015), International Steering Committee, Hong Kong, SAR, November 2015.

Optical Society of America's Frontiers in Optics (FiO), Fiber Optics and Optical Communications Symposium, Rochester, NY, October 2016.

Joint Meeting of the Glass and Optical Materials Division of the American Ceramic Society and of the Ceramic Society of Japan Annual Meeting, International Steering Committee, Kyoto, Japan, November 2016.

5th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS 2017, Porto, Portugal, February 2017.

Rare-Earth Doped Glasses and Ceramics for Photonic Applications, Glass and Optical Materials Division, American Ceramic Society, 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), Waikoloa, Hawaii, May 2017.

5th Workshop on Specialty Optical Fibers and Their Applications (WSOF2017), Limassol, Cyprus, October 2017.

Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE '17), Rome, Italy, November 2017.

6th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS 2018, Madeira, Portugal, January 2018.

International Advisory Board for the *Inorganic Materials Systems for Advanced Photonics* symposium at the 14th International Ceramics Congress, Perugia, Italy, June 2018.

Optical Fiber Communications Conference, OFC, Optical Society of America, Subcommittee D4 (Fiber and Propagation Physics), Los Angeles, CA, March 2018.

International Advisory Committee, International Conference on Optical, Optoelectronic and Photonic Materials and Applications (ICOOPMA), Brazil, August 2018.

International Advisory Board, International Commission on Glass (ICG) Annual Meeting, Yokohama, Japan, September 2018.

Specialty Optical Fibers (SOF) Conference, OSA Advanced Photonics 2018 Congress, Zurich, Switzerland, July 2018.

International Advisory Board, International Congress on Glass Annual Meeting, Yokohama, Japan, September 2018.

Advanced Solid-State Lasers (ASSL) Program Committee, OSA Laser Congress, Boston, MA, November 2018.

PHOTONICS 2018, International Conference on Fiber Optics and Photonics, New Delhi, India, December 2018.

7th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS 2019, Prague, Czech Republic, February 2019.

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2nd International Conference on Semiconductors, Optoelectronics and Nanostructures (ICSON-2019), Barcelona, Spain, August 2019

Conference Steering Committee and Program Scientific Committee, Photoluminescence in Rare Earths; Photonic Materials and Devices (PRE '19), Nice, France, September 2019.

Organizing Committee, International Summit and Expo on Optical Fibre Communications (Optical Fibre 2019) at Rome, Italy October 2019.

International Advisory Board of Symposium CL "Inorganic Materials Systems for Advanced Photonics," 15th International Ceramics Congress, Montecatini Terme, Italy, June 2020.

Fiber Lasers and Glass Photonics: Materials through Applications Conference, Photonics Europe 2020, Strasbourg, France, March 2020.

3rd International Conference on Semiconductors, Optoelectronics, and Nanostructures (Semiconductor-2020), Venice, Italy, August 2020.

8th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS 2020, Valletta, Malta, February 2020.

Advanced Functional Materials Congress, Stockholm, Sweden, March 2020.

2nd World Congress on Lasers, Optics and Photonics (WCLOP-2020), Osaka, Japan, June 2020.

Advanced Solid State Lasers (ASSL) Program Committee, OSA Laser Congress, Quebec City, Quebec, Canada, October 2020.

9th International Conference on Optical, Optoelectronic and Photonic Materials and Applications (ICOOPMA08), Pardubice, Czech Republic, August 2020.

Technical Program Committee (TPC) of the Micro-structured and Specialty Optical Fibres (MSSOP), Prague, Czech Republic, April 2021.

Optical Fiber Materials Symposium, International Commission on Glass (ICG) Annual Meeting, Songdo Convensia, Incheon, Korea, August 2021.

Global Summit and Expo on Laser, Optics and Photonics (GSELOP2021), Paris, France, August 2021.

Advanced Solid State Lasers Conference, OSA Laser Congress, Toronto, Canada, October 2021.

Optical Fiber Communications Conference, OFC, Optical Society of America, Subcommittee D5 (Fiber-optic and waveguide devices and sensors), San Diego, CA, March 2022.

Fiber optic sensor technologies and their applications workshop at the Optical Fiber Communications Conference, OFC, Optical Society of America, San Diego, CA, March 2022.

Fiber Lasers and Glass Photonics: Materials through Applications III Conference, Photonics Europe 2022, Strasbourg, France, April 2022.

Optical Fiber Communications Conference, OFC, Optical Society of America, Subcommittee D5 (Fiber-optic and waveguide devices and sensors), San Diego, CA, March 2023.

Lasers, Optics, Photonics, Sensors, Bio Photonics and Ultrafast Nonlinear Optics Conference (LOPS 2023), Fort Lauderdale, FL, June 2023.

Appendix A: Curriculum Vitae – Dr. John Ballato

Optical Fiber Communications Conference, OFC, Optical Society of America, Subcommittee D5 (Fiber-optic and waveguide devices and sensors), San Diego, CA, March 2024.

World Summit and Expo on Optics, Photonics and Lasers, Barcelona, Spain, March 2024.

Guest Editor:

IEEE Journal of Selected Topics in Quantum Electronics (IEEE) special issue entitled “Organic and Inorganic Photonic Materials,” with Profs. Larry Dalton (University of Washington), Setsuhisa Tanabe (Kyoto University), and Stuart Jackson (Macquarie University), Volume 14, Number 5, 2008.

Optical Materials Express (OSA) special issue entitled “*Specialty Optical Fiber*,” with Prof. Ayman Abouraddy (University of Central Florida), Volume 2, Issue 11, 2012.

International Journal of Applied Glass Science (ACerS / Wiley) special issue entitled “Glass and Nanotechnology – a Worldwide Perspective,” Volume 4, Issue 2, 2013.

International Journal of Applied Glass Science (ACerS / Wiley) special issue entitled “The Glass Age,” with Prof. Peter Dragic (University of Illinois), Volume 7, Issue 4, 2016.

Optical Materials Express (OSA) special issue entitled “*Advanced Multimaterial and Multifunctional Optical Fibers*,” with Profs. Daniel Milanese (University of Torino), and Fabien Sorin (EPFL), Volume 7, Issue 6, 2017.

Optical Materials (Elsevier) special issue entitled “Photoluminescence in Rare Earths 2016: Photonic Materials and Devices,” with Prof. Luiz Jacobsohn (Clemson University), Volume 68, June 2017.

Optical Materials Express (OSA) special issue entitled “*Optical Fiber Materials*,” with Profs. Heike Ebendorff-Heidepriem (University of Adelaide, Australia), Mukul Paul (Central Glass & Ceramics Research Institute, India), and Laetitia Petit (Tampere University of Technology, Finland), Volume 9, Issue 9, September 2019.

Sensors (MDPI), [Sensors] special issue on Optical Fibers for Distributed Sensors; with Prof. Peter Dragic (University of Illinois); published starting Feb 2019.

[Optical Materials Express \(OSA\) special issue honoring the UN International Year of Glass \(IYoG 2022\)](#); with Kathleen Richardson (Lead Editor, University of Central Florida, USA), Ulrich Fotheringham (SCHOTT AG, Germany), Mathieu Hubert (Corning Inc., USA), Stefan Nolte (Freidrich Schiller University/Fraunhofer IOP, Germany), and Laetitia Petit (University Tampere, Finland)

Applied Optics (Optica) Feature Issue on “Photonics and Optics Workforce,” with Lionel C. Kimerling (MIT, USA), Gilles Lamant (Cadence Design Systems, France), Nicholas Massa (Springfield Technical Community College, USA), and Azad Siahmakoun (Rose-Hulman Institute of Technology, USA).

Continuing Education:

Course Co-Director, Center for Professional Advancement

“Sol Gel Technology: The Chemistry, Characterization, and Applications in Ceramics and Glass,” 1998 – 2001, New Brunswick, NJ

“Sol Gel Technology: The Chemistry, Characterization, and Applications in Ceramics and Glass,” 1999 – 2001, Amsterdam, The Netherlands

“Ceramic Manufacturing,” 2001, New Brunswick, NJ

Technical Reviewer

Books: *Principles of Physical Optics* (C. Bennett, John Wiley & Sons, 2007; ISBN 0470122129), *Principles of Electronic Materials and Devices* (S. Kasap, 3rd Edition in preparation for possible 4th edition, McGraw-Hill, 2013; ISBN 0073104647)

Appendix A: Curriculum Vitae – Dr. John Ballato

Materials Journals: Advanced Materials, Angewandte Chemie, Synthetic Metals, Chemistry of Materials, NanoLetters, Journal of Non-Crystalline Solids, Journal of Physics and Chemistry of Solids, Journal of Materials Research, Nanotechnology, Journal of the American Ceramic Society, Journal of Inorganic Materials, Optical Materials, Thin Solid Films, Journal of Vacuum Science and Technology, Materials Letters, European Journal of Chemical Physics and Physical Chemistry, Materials Today, Physics and Chemistry of Glasses, Physics and Chemistry of Minerals.

Optics Journals: Nature Photonics, Nature Communications, Optics Letters, Applied Optics, Optics Express, Optical Materials Express, Journal of Physics and Chemistry of Solids, Journal of Polymer Science, IEEE Journal of Quantum Electronics, Photonics Technology Letters, Journal of the Optical Society of America B, Optics Communications, Journal of Lightwave Technology, Materials Letters, IEEE/OSA Journal of Display Technology, Journal of Biomedical Optics, Chinese Optics Letters.

Physics Journals: Applied Physics Letters, Chemical Physics Letters, Electronics Letters, Journal of Applied Physics, Journal of Physics, European Physics Journal D – Optical Physics, Solid State Sciences, Plasmonics, Journal of Microlithography, Microfabrication, and Microsystems.

Chemistry Journals: Langmuir, Journal of Polymer Science, Journal of the Electrochemical Society, Journal of Photochemistry and Photobiology A: Chemistry.

Organizations: National Science Foundation, US Army Research Office, US Department of Energy, Research Corporation, National Academy of Science (National Materials Advisory Board), US Civilian Research and Development Foundation (US Department of State), The National Priorities Research Program (NPRP) of the Qatar National Research Fund, Shota Rustaveli National Science Foundation of Georgia (SRNSF).

Promotion/Tenure: External review for promotion/tenure/reappointment of faculty at Toyota Technological Institute (Nagoya, Japan), University of Arizona, Optical Sciences Center (Tucson, AZ), The University of Wisconsin (Milwaukee, WI), Tulane University (New Orleans, LA), Peking University (Beijing, China), Missouri University of Science & Technology (Rolla, MO), Soreq Nuclear Research Center (Israel), Macquarie University (Australia), the Southern University of Science and Technology (China), Nanyang Technological University (Singapore), and Al Hussein Technical University (Jordan).

Other:

Clemson representative to ACI short course *The Legal and Business Forum on Nanotechnology* (Boston, MA June 2003).

Glass and Optical Materials Division representative to *American Ceramic Society Leadership Workshop* (Westerville, OH August 2003).

EPSCoR Center Leadership Workshop (Washington, DC; February 2005).

Electronics Coordinating Group Strategic Planning Committee for the Electronics Division of the Army Research Office (ARO).

Working Committee for the DoE Workshop on Laser Technology for Accelerators (2013).

Advisory Planning Group for American Ceramic Society proposal to host the 2019 International Commission on Glass (ICG) Congress (2013 - 2015).

Invited Panelist: The NSF Professional Development Workshop in Ceramics; Workshop sponsored by the Ceramics Program in the Division of Materials Research (DMR) of the U.S. National Science Foundation (NSF) to focus on research and professional development activities for early-career faculty who are investigating ceramic materials and have recently been awarded NSF CAREER grants.

Appendix A: Curriculum Vitae – Dr. John Ballato

International Conference & Exhibition on Advanced & Nano Materials (ICANM 2013), August 2013, Quebec City, Canada.

Judge, *Collegiate Inventors Competition* (National Inventors Hall of Fame, 2016).

Invited Panelist: Weapons and Defense Expert Panel to inform the U.S. Air Force Strategy 2030; invitation on behalf of the Secretary of the Air Force and the Air Force Research Laboratory (2018).

Invited Panelist: Future of Directed Energy Workshop, CCDC Army Research Laboratory Futures (2019).

Team leader for *optical fiber materials*: “Nonlinear optics data for emerging materials,” Institute of Physics (IoP; 2020 – 2023).

Member, SC Governor’s Award Selection Committee (2023 – 2025).

Co-Chair: Targeting Industrial Marketing and Recruitment Task Force – Photonics, Upstate Alliance (2004 – 2012).

Member: InnoVenture Grassroots Legislative committee (2006 – 2012).

Charles Townes Statue/Plaza Committee, Greenville, SC (2004 – 2006)

University / Departmental

Chair Tenure and Promotion Committee, Materials Science and Engineering (2019 – present).

Chair Exxon Mobil Endowed Chair, School of Mechanical and Automotive Engineering (2022).

Chair Ad-hoc Committee for the Dean’s Bishop Faculty Fellow Award (2022).

Chair Department Chair Review Committee, Materials Science and Engineering (2020 – 2021).

Chair George Bishop Endowed Chair Search Committee, Materials Science and Engineering (2019).

Mentor Mentor to Dr. Joe Mazer, Professor and Chair of the Department of Communication, College of Behavioral, Social and Health Sciences, Clemson University (2019 – 2021). Dr. Mazer is now the Dean of the College of Communication and Information, University of Tennessee.

Chair Research misconduct investigation committee (2018).

Chair Kentwood Distinguished Professorship Search Committee, Materials Science and Engineering (2018).

Co-Chair SCIENCE Forward, the strategic plan for the College of Science (2017).

Chair Materials Science and Engineering, (Two) Junior Faculty Search (2016 - 2017).

Chair Class of ’39 Award Selection Committee, Clemson University (2015).

Chair President’s Select Committee on Innovation and Economic Prosperity designation from the Association of Public Land Grant Universities (2015).

Chair Class of ’39 Award Selection Committee, Clemson University (2014).

Chair Committee for Innovation and Economic Prosperity University (IEP) designation from the Association of Public and Land Grant Universities (APLU), Clemson University (2014).

Chair Materials Science and Engineering, (Two) Junior Faculty Search (2012).

Chair Sirrine Endowed Chair in Optical Fiber Search Committee, Clemson University (2012).

Chair Faculty Search Committee, School of Materials Science and Engineering (2012).

Chair Sigma Xi Research of the Year Award Committee, Clemson University (2011 – 2012).

Chair Clemson University Export Control Officer Search Committee (2010 – 2011).

Appendix A: Curriculum Vitae – Dr. John Ballato

Chair	Clemson University Conflict of Interest and Conflict of Commitment Policy Committee (2010 – 2011).
Chair	Clemson University Research and Economic Development Strategic Plan Committee (2008 – 2009).
Chair	Clemson University Research and Economic Development Tactical Plan Committee (2009).
Co-Chair	Clemson University Select Committee on Enhancing Clemson's National Academic Reputation (2007 – 2008; with Dr. Karen Burg).
Chair	Research Center of Economic Excellence Endowed Chair in Optical Materials Search Committee, Clemson University (2005-2006).
Chair	Department Chair Search Committee, School of Materials Science and Engineering (2004-2005).
Chair	Intellectual Property Policy Review Sub-Committee II, Clemson University (2003 - 2004).
Chair	Bishop Endowed Chair Search Committee, School of Materials Science and Engineering (2002).
Chair	Curriculum Revision Committee, Department of Ceramic and Materials Engineering (2000).
Chair	Department Chair Search Committee, Ceramic and Materials Engineering Department (1999).
Member	Self Family Foundation Endowed Chair in Human Genetics Special Review Committee, College of Science (Provost's appointee, 2023).
Member	Miller Chair search committee, Department of Physics and Astronomy, College of Science (Provost's appointee, 2022).
Member	Thomas Green Clemson Academy and Outstanding Young Alumni Awards Committee (2021).
Member	Robert A. Bowen Professorship search committee, College of Science (Provost's appointee, 2021).
Member	Provost appointee to College of Science endowed and title professor reappointment review committee (2020).
Member	Ad-hoc Committee for the Dean's Bishop Faculty Fellow Award (2019).
Member	Bishop Endowed Chair Search Committee, Materials Science and Engineering (2019).
Member	Advisory Board to the Clemson Science Policy Network (2018 – present).
Member	Clemson University Safety Culture Task Force (2016 – 2018).
Member	Clemson University Conflict of Interest Committee (2016 – present).
Member	Materials Science and Engineering Tactical Implementation Committee (2015).
Member	Clemson University Class of '39 Award Selection Committee (2015).
Member	Faculty Representative to the Clemson University Board of Trustees Selection Committee (2015).
Member	Materials Science and Engineering Department Chair Review Committee (2015).
Member	Vice President for Academic Affairs and Provost Search Committee, Clemson University (2014 – 2015).
Member	Clemson University Research Foundation Board of Directors (2014 – 2015).
Member	College of Engineering and Science Mentoring/Leadership Awards Committee (2014).
Member	Materials Science and Engineering Strategic Planning Committee (2014 – present).
Member	Director of Licensing Search Committee, Clemson University Research Foundation (CURF; 2013 – 2014).
Member	Clemson University Electron Imaging Laboratory Advisory Board (2013 – present).
Member	College of Engineering and Science Mentoring/Leadership Awards Committee (2013).
Member	Samuel Bell Distinguished Professorship Search Committee (2012 – 2013).
Member	Clemson University Research Foundation (CURF) Strategic Plan Committee (2012 – 2013).

Appendix A: Curriculum Vitae – Dr. John Ballato

- Member Sigma Xi Research of the Year Award Committee, Clemson University (2012 – 2013).
- Member Faculty Representative to the Clemson University Board of Trustees Selection Committee (2012).
- Member Electron Microscopy Laboratory Director Search Committee, Clemson University (2012).
- Member Faculty Representative to the Clemson University Board of Trustees Selection Committee (2011).
- Member School of Materials Science and Engineering Director Search (2011 – 2012).
- Member University Intellectual Property Committee, College of Engineering and Science representative (2003 – 2006); Office of Advancement representative (2006 – present).
- Member Ombudsman Committee, Clemson University (2006 – 2008, *ex officio* Faculty Representative to Board of Trustees).
- Member Search Committee for Director for Federal Relations (Office of Governmental Affairs, 2008).
- Member Program Committee for Clemson University Cyberinfrastructure (CI) Days (2008).
- Member Engineering Building Master Plan Committee (College of Engineering and Science, 2007).
- Member Clemson University Conflict of Interest Policy (General Counsel's Office, 2007, 2009).
- Member Graduate Roadmap Taskforce, Clemson University (2006).
- Member Advanced Materials project team, Clemson University (2004 – 2006).
- Member Economic Development/Economic Impact project team, Clemson University (2005 – 2006).
- Member President's Leadership Summit (2005).
- Member University Research Grants Committee, College Representative (2005 – 2007).
- Member Spiro Professor of Entrepreneurship Search Committee, College of Business and Behavioral Science, Clemson University (Provost's appointee, 2003).
- Member Telecommunications Task Force, Clemson University (2003 – 2004).
- Member *Ad Hoc* Committee at Clemson to define Review Criteria for SC Research Centers of Economic Excellence Endowed Professorship program (2003).

SECTION VIII – PERSONAL INFORMATION

- Born 9 January 1971 in New York, New York.
- Three children (birth year): Elijah Louis (2004), Abram Nathan (2007), and Eva Grace (2009).
- Personal Fitness
 - Enjoys golf, swimming, tennis, and running
 - Successfully completed the Spartan Beast™ (2012), (Clemson) Easter Bunny Half Marathon (2012), Savannah Marathon (2012), Spartan Sprint™ (2013), Spartan Super™ (2013), Spartan Beast™ (2013), Jacksonville Half Marathon (2013), Greenville Half Marathon (2015), New Jersey Half Marathon (2016).

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