

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

STRUCTURAL WRAP, LLC,
Petitioner

v.

SYSTEM STORMSEAL PTY LTD, STORMSEAL USA, LLC,
Patent Owner

Case IPR2024-00084
Patent 11,168,484

**EXPERT DECLARATION OF YASH P. KHANNA, PH.D. IN SUPPORT
OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,168,484**

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I, Dr. Yash P. Khanna, declare under penalty of perjury:

I. INTRODUCTION

1. I have been retained by Groombridge, Wu, Baughman & Stone LLP, on behalf of Structural Wrap, LLC (“Structural Wrap”) to offer statements and opinions regarding certain issues related to U.S. Patent No. 11,168,484 (“the ’484 patent”) (EX1001), as well as prior art documents.

2. I am being compensated for my time at my standard consulting rate of \$275 per hour for all work except deposition or trial testimony, and \$375 per hour for deposition and trial testimony. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is not contingent upon the results of my study, the substance of my opinions, or the outcome of any proceeding. I have no financial interest in the outcome of this matter or in the pending litigations involving Structural Wrap; System Stormseal Pty Ltd and Stormseal USA, LLC (together, “Stormseal”); and SRS Distribution Inc.

II. BACKGROUND AND QUALIFICATIONS

3. Attached hereto as Appendix A is a true and correct copy of my curriculum vitae describing my background and experience, and listing my publications and US patents. I have not provided expert testimony (including in an expert report, declaration, deposition, or trial) in the last five years.

4. Much of my educational training as well as my industry experience in heat shrinkable films are relevant to the subjects of this declaration.

5. I earned a Bachelor of Science in Chemistry and a Master of Science in Chemistry from the University of Delhi. In 1974, I earned a Master of Science in Modern Methods of Chemical Analysis & Process Control from the Indian Institute of Technology, Delhi. In 1975, I earned a Master of Science in Polymeric Materials and, in 1980, a Ph.D. in Polymer Science & Engineering from the Polytechnic Institute of New York, now New York University.

6. I have nearly 50 years of industry experience in the thermal analysis and structure-property relationships of polymers. Thermal analysis is the term used for a group of analytical techniques to measure physico-chemical changes in a material when subjected to heat, such as dimensional changes, extension or shrinkage.

7. I was awarded the Society of Plastics Engineers' International "Engineering/Technology" Award in 2001 for fundamental contributions to the field of plastics. I was awarded the North American Thermal Analysis Society's Fellowship in 1988, and then its highest honor, the Mettler Award, in 1997, for outstanding contributions to thermal analysis of polymers.

8. I am a named inventor on over 20 U.S. patents in the field of plastics. I also have around 120 publications, with about 80 of those in peer-reviewed, pres-

tigious polymer/plastics journals, such as *Polymer Engineering & Science*, *Macromolecules*, and *Journal of Polymer Science: Polymer Physics Edition*. Over the years, I have been chosen to review numerous publications and books related to polymer science and technology.

9. I had a long career (January 1975 - October 2001) at Honeywell, formerly AlliedSignal, in its Corporate Research & Technology Center's Thermal Analysis Group. During 1985-2001, I was the Research Group Leader / Senior Principal Scientist and head of the Thermal Analysis Laboratories, investigating how materials change when subjected to heat.

10. As the head of Thermal Analysis, I solved problems related to plastic resins and films, for example, dimensional stability, optical properties, root-cause investigations of defects during retort operations, occurrence of gel defects, and bubble instability during blown film processing. My work included managing the thermal analysis laboratories and conducting extensive research on plastic films, including extension and shrinkage dependence on thermal and mechanical histories.

11. My innovative work on properties of plastics as affected by heat treatment, including work that was patented and published, led me to be invited as a business unit liaison to the Specialty Films division and a Key Technologist for Packaging Resins division at Honeywell. In those roles, I offered consultation to customers in North America and Europe from 1994-2001, working on, for example,

dimensional stability of films as controlled by draw-ratio, heat-setting, and other physico-chemical variables. My contributions were recognized by Honeywell through five Special Recognition awards and three Business awards, namely, “Growth of the Year,” “Sale of the Year,” and “Save of the Year.”

12. After retiring from Honeywell in 2001, and through the present, I have had several consulting roles relating to the performance of plastic resins as well as plastic films, including shrink wrap performance.

13. Throughout my career, and through the present, I have studied, published on, and lectured on numerous polymers such as polyethylene (PE) (including both non-linear (sometimes called ordinary or conventional) low density polyethylene and linear low density polyethylene, and several types of polyethylene copolymers (e.g., EVA, EAA, EMMA-Na, EVOH)), polypropylene (PP), polyvinyl chloride (PVC), polyvinylidene chloride (PVdC), polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polystyrene (PS), polycarbonate (PC), fluoropolymers such as Teflon, PFA, PVdF, and PCTFE, and BIO-Polymers, such as polyvinyl alcohol (PVOH) and polylactic acid (PLA), and their blends.

14. Since 1995, and through the present, I have taught courses on polymeric films, polymer melt rheology, thermal properties, and analytical sciences, including a course involving polymer industry problem solving via excellence in analytical sciences, in the U.S. and Europe.

15. Currently, I am the President/Owner of Innoplast Solutions, a consulting business specializing in polymer-related problems. I have had lectured extensively at academic institutions as well as business organizations and conferences, around the globe, namely, in the U.S. and Canada, and throughout Europe, Japan, China, India, and Israel.

16. Other details concerning my background, academic work, and professional history are set forth in Appendix A.

III. THE '484 PATENT AND LEVEL OF ORDINARY SKILL

17. I have read Stormseal's '484 patent. I have been advised that Stormseal asserts that claims 1-3 are entitled to a priority date of at least June 2, 2008. I assume a June 2, 2008 priority date for the purposes of my opinions herein.

A. Persons of Ordinary Skill in the Art ("POSITA")

18. I understand that certain factors may be considered in determining the level of ordinary skill in the art related to a patent. These include (1) the levels of education and experience of persons working in the field; (2) the types of problems encountered in the field; and (3) the sophistication of the technology at the time of the invention. I understand that not every factor may be present in a particular case.

19. I understand that POSITA are not specific real individuals, but rather hypothetical individuals having the qualities reflected by the factors above. I understand that POSITA are presumed to have knowledge of all relevant prior art, and

would thus have been familiar with (and would have knowledge of the teachings of) each of the references discussed below. I understand that POSITA, in many cases, are able to fit the teachings of multiple references together. I further understand that POSITA are also persons of ordinary creativity.

20. I understand that the '484 patent purports to cover a “covering of a damaged or uncompleted building; the covering including a film of heat shrinkable material stretched over damaged or uncompleted portions of the building; the film formed as a sheet comprising an assembly of lengths of the heat shrinkable material applied to surfaces of the building.” EX1001 (**'484 patent**), Abstract. The specification states that the “present invention relates to protective covering of roofs and walls of a building and, more particularly, to the covering of damaged or under construction roofs, as well as the covering of walls of buildings.” EX1001 (**'484 patent**), 1:15-18. Claim 1 of the '484 patent includes a recitation that the film be “of low density polyethylene including shrinking resins.”

21. Therefore, the field of art relevant to at least claim 1 includes (apart from the protective covering of buildings aspects) materials science related to heat shrinkable films. In my opinion, a person of ordinary skill in the materials science aspects pertinent to at least claim 1 of the '484 patent (apart from the protective covering of buildings aspects), as of June 2, 2008, would have at least a bachelor's

degree in chemistry, materials science or engineering, polymer science or engineering, or a related subject, and at least one or two years of practical experience involving the composition and processing of heat shrinkable plastic films. More advanced educational training focused on polymer science or engineering related to heat shrinkable plastic films could substitute for the practical experience; and significant practical experience with the composition and processing of heat shrinkable plastic films could substitute for formal educational training.

22. I base this opinion on the level of technical training I believe is required to practice the concept recited in claim 1, and described in the prior art, of having a heat shrinkable film of low density polyethylene including shrinking resins; on my decades of experience working on the composition and processing of heat shrinkable plastic films; and on supervising others (including persons of ordinary skill as it pertains to the materials science aspect of at least claim 1) in such work.

23. Well before June 2, 2008, my level of skill in the art was at least that of POSITA with respect to the materials science aspects pertinent to at least claim 1 of the '484 patent. I am qualified to provide opinions concerning what such POSITA would have known and understood at that time. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions (including as they specifically relate to the references I consulted) are from the perspective of POSITA as it pertains to the materials science aspect of at least claim 1, as of June 2, 2008.

B. Claim Construction

24. I have been advised that claim terms are presumed to have their ordinary and customary meaning in light of the patent's specification as understood by POSITA at the time of invention, unless 1) the patentee sets out a definition and acts as his own lexicographer, or 2) the patentee disavows the full scope of a claim term either in the specification or during prosecution.

25. The term “shrinking resins” is not defined in the '484 patent and is not otherwise provided with a special meaning in the patent (EX1001) or its prosecution history (EX1002). Additionally, the term “shrinking resins” did not have in June 2, 2008 (and continues not to have) any special meaning in the industry of shrinkable plastic films. In my analyses, therefore, I apply the term's plain and ordinary meaning as it would have been understood by POSITA in June 2, 2008 in light of the specification. Based on the specification, POSITA would not have understood claim 1's recitation of “a film of low density polyethylene including shrinking resins” to require anything beyond a film of low density polyethylene resins oriented to provide heat shrinking properties (as I describe below, *infra* ¶¶28-31).

IV. MATERIALS RELIED UPON

26. In reaching the conclusions described herein, I relied on the documents cited in this Declaration and those identified in Appendix B. The materials are patents, related documents, and printed publications, and each is a type of document that experts in my field would reasonably rely on in forming their opinions.

27. My opinions are also based upon my education, training, research, knowledge, and personal and professional experience.

V. OPINIONS ON THE STATE OF THE ART OF HEAT SHRINKABLE FILMS

28. Well before June 2, 2008, POSITA knew that resins are the core ingredient to all plastic film products. *See, e.g.,* EX1039 (**Briston, *Plastic Films*, 1989**), 10, 21-22¹; EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 34, 72. As part of

¹ EX1039 is a copy of excerpts from the Third Edition of the textbook *Plastic Films* by John H. Briston. EX1039 (**Briston, *Plastic Films*, 1989**), 3. The copyright page of EX1039 says “Third edition 1989.” EX1039 (**Briston, *Plastic Films*, 1989**), 3. I received a hard copy of the 1990 reprint of this same textbook as a gift in 1997. EX1047, 2. The copyright page of my textbook appears identical to EX1039, except it also states, “Reprinted 1990.” EX1047, 5. I sent my textbook

the process of manufacturing plastic films, film manufacturers obtain polymeric materials, usually of synthetic origin, frequently called resins (such as polyethylene resins), which are typically in the form of pellets or powder, from raw material suppliers, such as petrochemical companies. *See, e.g.*, EX1039 (**Briston**, *Plastic Films*, 1989), 21-22; EX1038 (**Rapra**, *Handbook of Plastic Films*, 2003), 34.

29. The resins (typically in the form of pellets, and including a combination of different types of resins) are processed into heat shrinkable films. Exemplary resins used to make heat shrinkable film include polyethylene, polypropylene, polyvinyl chloride, polyethylene terephthalate, and Nylon 6. *See, e.g.*, EX1038 (**Rapra**, *Handbook of Plastic Films*, 2003), 42-43, 47-48; EX1039 (**Briston**, *Plastic Films*, 1989), 65, 68; EX1033 (**Talbot 509**), 2:66-3:1 (“The film may comprise any of those conventionally used in shrink packaging, such as polyvinyl chloride, polyethylene, polypropylene and the like.”).

30. The resin pellets are melted and formed into a continuous profile using a manufacturing process called extrusion. In the process, molten resins are typically squeezed through an opening called a die and then cooled to form the film. *See, e.g.*,

via USPS to Groombridge, Wu, Baughman & Stone LLP. I understand that excerpts of my textbook were scanned to create exhibit EX1047. All the information I cite and refer to herein from EX1039 is also provided in my textbook (EX1047).

EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 34-35; EX1039 (**Briston, *Plastic Films*, 1989**), 68-76. Before fully cooling the film, the manufacturer stretches the film, thereby orienting the molecules in a uniaxial or biaxial direction, which is a distortion from their preferred random coil shape. EX1039 (**Briston, *Plastic Films*, 1989**), 29-30, 65-66 (“The principle on which shrink wrapping is based is sometimes referred to as ‘plastic memory’. In other words a film which has been stretched during manufacture (at a temperature above its softening point) and then cooled to ‘freeze-in’ the consequent orientation of the molecules, will tend to return to its unstretched dimensions when re-heated.”); EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 42-43 (“To produce film shrinkable in a given direction, molecular chains must be oriented in the same direction by processing. This orientation is obtained by stretching the film in the required direction. The greater the film stretching, the higher the molecular orientation and hence the shrinkage.”). The molecular orientation/internal stress introduced by stretching the film is effectively “frozen” or locked into the film by cooling, such as air cooling. *See, e.g.*, EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 40; EX1039 (**Briston, *Plastic Films*, 1989**), 30-31, 66-67.

31. Upon application of heat, this stress is released, and the molecules return to their random coil shape, which shrinks the film. *E.g.*, EX1007 (**Best**), 21:7-9 (“Such films are capable of shrinking upon application of heat to release stress

imparted to the film during or subsequent to extrusion.”); EX1032 (**Ohlsson**), ¶2 (“Such films are capable of shrinking upon application of heat to release stress imparted to the film during or subsequent to extrusion.”); EX1039 (**Briston, *Plastic Films*, 1989**), 65-66, 72 (“Shrink wrapping is based on the fact that a plastics film which has been stretched during its manufacture will revert to its original dimensions when heated.”); EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 40-41 (“Thus, the internal stresses are released, causing the film to shrink.”). This process was well known before June 2, 2008. *E.g.*, EX1007 (**Best**), 21:7-9; EX1032 (**Ohlsson**), ¶2; EX1039 (**Briston, *Plastic Films*, 1989**), 29-30, 65-66; EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 40-41.

32. For decades, and well before June 2, 2008, low density polyethylene (LDPE) resins have been used to make heat shrinkable films, which have been used for numerous and varied applications. *See, e.g.*:

- EX1033 (U.S. Patent 4,247,509 (**Talbot 509**)) (issued January 27, 1981), 2:66-3:6 (heat shrinkable film of low density polyethylene to wrap boats);
- EX1034 (U.S. Patent 4,763,783 (**Talbot 783**)) (issued August 16, 1988), 5:23-42 (heat shrinkable film of low density polyethylene to wrap aircraft);

- EX1039 (**Briston, *Plastic Films*, 1989**), 68, 73 (shrink wrapping a pallet load with a “low density polyethylene film”);
- EX1021 (**Americover**), 1 (webpage I understand to have been publicly available as of October 16, 2006) (heat shrinkable film of low density polyethylene to wrap, for example, buildings, scaffolding, bridges, and ships); and
- EX1007 (US Patent 7,951,873 (**Best**)) (filed April 18, 2007), 2:11-19, 15:8-35, 21:4-22:25 (heat shrinkable film of low density polyethylene to wrap, for example, houses).

33. LDPE resins are commonly used and were commonly used well before June 2, 2008 to make heat shrinkable films. *E.g.*, EX1039 (**Briston, *Plastic Films*, 1989**), 72 (“Shrink wrapping is another large outlet for low density polyethylene film and one that is still growing.”); EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 48 (“**LDPE and LLDPE** are common materials for shrink films.”); EX1007 (**Best**), 21:21-27 (“The main structural component of such industrial shrink films is [] typically high pressure, *low density polyethylene (LDPE)*, *often blended with up to about 30 weight percent of linear low density polyethylene (LLDPE)* to reduce problems of hole formation during shrinkage.”); EX1010 (**Myhre**), 1:17-20 (“At present, the most widely used material for shrink film production is *low density pol-*

yethylene (LDPE), optionally blended with other polymers to achieve a desired balance of properties (e.g. stiffness) and cost.”), EX1009 (**Lachapelle**), 6:57-61 (“Preferably, the liner [] is made out of a stretchable material such as *low density polyethylene* film.”); EX1032 (**Ohlsson**), ¶¶2-3 (“Industrial shrink films” are typically made of “high pressure, *low density polyethylene (LDPE)*, *often blended with up to about 30 weight percent of linear low density polyethylene (LLDPE)*” and made by “impart[ing]” “stress” “to the film during or subsequent to extrusion”); EX1033 (**Talbot 509**), 2:66-3:10 (disclosing the use of “*low density*” “*polyethylene* film,” “having approximately equal shrink coefficients in transverse and longitudinal directions, i.e., biaxially-oriented,” for shrink wrapping boats); EX1034 (**Talbot 783**), 5:23-27 (disclosing the use of “*low density polyethylene*” “adapted to shrink in both the lateral and longitudinal directions upon the application of heat” to shrink wrap aircraft).²

34. Low density polyethylenes are typically defined as having a density of approximately 0.91 to 0.94 g/cm³. *See, e.g.*, EX1007 (**Best**), 7:60-62; EX1038 (**Rapra, Handbook of Plastic Films, 2003**), 12-13, 29, 31, 50; EX1039 (**Briston, Plastic Films, 1989**), 12-13. Low density polyethylene was first prepared, in the 1930s, using a high pressure process, resulting in great deal of long chain branching,

² All emphases herein are added unless noted otherwise.

which has an important bearing on the properties of the polyethylene. EX1039 (**Briston, *Plastic Films*, 1989**), 10-11; EX1007 (**Best**), 7:60-67. By at least the 1950s, low density polyethylenes were also produced either by low pressure gas phase polymerisation or by liquid phase processes, resulting in what would be later known as linear low density polyethylene (LLDPE). EX1039 (**Briston, *Plastic Films*, 1989**), 13; EX1007 (**Best**), 8:1-15. Given its low density, LLDPE is a low density polyethylene. In other words, LLDPEs are a subcategory of low density polyethylenes. *See, e.g.*, EX1007 (**Best**), 2:4-9 (describing “low density polyethylene” as either “linear” or “non-linear”); *see also, e.g.*, EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 46 (“The most common film used in packaging is *low-density polyethylene (LDPE)*, defined broadly to include linear low-density polyethylene (LLDPE).”). However, although the polyethylene resulting from the newer low pressure gas phase polymerisation or liquid phase processes is a low density polyethylene, some properties of LLDPE are different than those of conventional (non-linear) LDPE, including, for example, that LLDPE has linear molecules and shorter chain branching. EX1039 (**Briston, *Plastic Films*, 1989**), 13; EX1007 (**Best**), 8:1-15; EX1038 (**Rapra, *Handbook of Plastic Films*, 2003**), 50.

35. In my opinion, well before June 2, 2008, the prior art disclosed using heat shrinkable films of low density polyethylene including shrinking resins to cover a house and other structures.

36. For example, Americover, a webpage I understand was publicly available at least by October 16, 2006, discloses “heat shrink films” “made using Low Density Polyethylene containing fractional melt virgin resins,” which, “[w]hen the film is subjected to heat,” causes the film to “shrink[] in all directions” “allowing the film to mold itself to just about any surface” that is a “skin-like protective covering.” *E.g.*, EX1021 (**Americover**), 1. Americover states that its heat shrink film has a variety of purposes including “[p]rotection from the elements” of “[h]urricane and storm damaged structures” and acting as a “covering” for a “[b]uilding[.]” *E.g.*, EX1021 (**Americover**), 1.

37. Another reference, Best, a U.S. patent whose application was filed April 18, 2007, discloses heat shrinkable films made of non-linear LDPE resins (both without LLDPE and blended with LLDPE), as discussed below. *See infra* ¶¶49-51. As POSITA would have understood, blending non-linear and linear LDPE resins results in a film of non-linear and linear low density polyethylenes. Best also discloses using these heat shrinkable films to cover a house. For example, Best discloses using non-linear LDPE resins (both with and without LLDPE resins), to make heat shrinkable films used as a “housewrap.” *E.g.*, EX1007 (**Best**), 1:61-2:23, 15:8-19, 21:4-22:28.

38. Further, the ’484 patent states in its background section that it was prior art practice to provide a “weather resistant wrap” over a building structure using a

material “typically in the form of a flexible plastic film such as polyethylene.” EX1001 (**’484 patent**), 2:3-12.

39. Additionally, *Plastic Films* (EX1039) teaches that “polyethylene film is extensively used as a lightweight tarpaulin for covering up materials and equipment on site,” and that “[e]ven more important is the use of low density polyethylene film as a weatherproof covering for building in progress,” including “covering the whole building.” *E.g.*, EX1039 (**Briston, *Plastic Films*, 1989**), 75. *Plastic Films* teaches that, “[a]part from being cheaper than the normal tarpaulin,” polyethylene is “particular[ly] advantag[eous]” in covering buildings because it is lightweight, more easily handled, and transparent, “which means that shelter from the rain, etc., is supplied without blocking out the daylight.” *E.g.*, EX1039 (**Briston, *Plastic Films*, 1989**), 75.

VI. HEAT SHRINKABLE FILMS OF LOW DENSITY POLYETHYLENE INCLUDING SHRINKING RESINS WERE TAUGHT BY THE PRIOR ART

A. Legal Standards

40. I understand that a prior art reference can disclose a claimed feature either because that feature is described in the prior art reference, or because that feature is inherent in the disclosure of the prior art reference. I understand that for a claimed feature to be described in a prior art reference, the exact words of the claim need not be used. Additionally, I understand that something is inherent in a prior art

reference only if the missing descriptive matter must necessarily be present. I also understand that inherency cannot be established by probabilities or possibilities, and the mere fact that something may result from a given set of circumstances is not enough for inherency.

41. I have also been advised that, even though every element of a claim is not shown or sufficiently described in a single prior art reference, the claim may still be invalid if it would have been obvious to POSITA at the relevant time. I have been advised that a claim may be invalid as obvious if any differences between the claimed invention and the prior art are such that the claimed invention, as a whole, would have been obvious to POSITA in view of a prior art reference or in view of a combination of references at the time the claimed invention was made. I understand that obviousness is determined from the perspective of POSITA and that the asserted claims of the patent should be read from the point of view of POSITA at the time the claimed invention was made.

42. I have also been advised that, in considering whether a claimed invention would have been obvious, I consider whether, at the time of the claimed invention, there was a reason that would have prompted POSITA to combine the known elements in the prior art in a way the claimed invention does, taking into account such factors as (1) whether the claimed invention was merely the predictable result of using prior art elements according to their known functions; (2) whether the

claimed invention provides an obvious solution to a known problem in the relevant field; (3) whether the prior art teaches or suggests the desirability of combining elements claimed in the invention; (4) whether the prior art teaches away from combining elements in the claimed invention; and (5) whether it would have been obvious to try the combinations of elements, such as when there is a design incentive or market pressure to solve a problem and there are a finite number of identified, predictable solutions.

43. I further understand that certain objective considerations (sometimes called “secondary considerations”) may be considered in determining obviousness, if they are present, such as: commercial success (including the profitability of the claimed method), long-felt but unsolved need, teaching away (including references telling POSITA not to do something that would be required by the claims), unexpected results, copying, and praise by others in the field. I understand, however, these factors are relevant only if there is a connection, or nexus, between the factor and the novelty covered by the patent claim. I also understand that even if they are present, these objective considerations may be unable to overcome primary evidence of obviousness (including motivation to combine with predictable results) that is sufficiently strong.

44. I also understand that, for a patent to be obvious, POSITA must have had, in addition to a motivation to combine, a reasonable expectation of success in

practicing the claimed invention based on the prior art. Whether POSITA would have had a reasonable expectation of success in practicing the claims is determined based on the degree of unpredictability in the art as well as the guidance provided by the art.

B. Opinions Regarding Best

45. In my opinion, Best et al. (EX1007) discloses heat shrinkable films of low density polyethylene including shrinking resins, including by describing “heat-shrinkable films” prepared using non-linear LDPE resins (with or without LLDPE resins). *E.g.*, EX1007 (**Best**), 1:61-2:23, 21:4-22:3.

46. POSITA would have been motivated to use films of non-linear LDPE (with and without LLDPE). POSITA would have understood that films made of only non-linear LDPE, which is made using the conventional high-pressure processes, are generally more readily available, are more easily manufactured, and generally result in a cheaper film (by weight) than films of only LLDPE. *See, e.g.*, EX1038 (**Rapra, Handbook of Plastic Films, 2003**), 13-14 (long branches of non-linear LDPE are more easily processed), 50 (“LDPE is generally the cheapest plastic film, on a per-unit-mass basis.”). Whether to blend LLDPE resins with the non-linear LDPE resins would have depended on the POSITA’s design priorities and budget. For example, POSITA with a lower budget and less concerned about the film’s long-term durability would have been motivated to use a heat shrinkable film

made of only non-linear LDPE resins. POSITA would have also understood that heat shrinkable films of only non-linear LDPE resins (without LLDPE) were advantageously used to cover structures, including large outdoor structures. *E.g.*, EX1033 (**Talbot 509**), 2:66-3:6 (boats); EX1034 (**Talbot 783**), 5:23-42 (aircraft); EX1039 (**Briston, Plastic Films, 1989**), 14, 68 (pallet loads), 75; EX1021 (**Americover**), 1 (buildings). Best's films of non-linear LDPE resins (without LLDPE resin) would have therefore been an obvious and commonplace choice for these POSITA.

47. POSITA would have further understood that, as another alternative appropriate when, *e.g.*, longer-term durability is more important as a design priority, blending linear and non-linear LPDE resins generally produced a more durable film, reducing the risk of holes forming in the film, and had other advantages, such as reduced haze. *E.g.*, EX1007 (**Best**), 21:21-25 ("The main structural component of such industrial shrink films is [] typically high pressure, low density polyethylene (LDPE), often blended with up to about 30 weight percent of linear low density polyethylene (LLDPE) to reduce problems of hole formation during shrinkage."); *see also, e.g.*, EX1038 (**Rapra, Handbook of Plastic Films, 2003**), 67 ("For instance, the LLDPE/LDPE blend is characterised by reduced haze and better bubble stability."); EX1007 (**Best**), 21:53-60, 21:61-2212, 23:13-18, Tables 2, 3, 13, 15, 16, 17, 18, 21, 22, 23. Blending non-linear and linear LDPE also has some advantages related to processing the film. *E.g.*, EX1038 (**Rapra, Handbook of Plastic Films,**

2003), 14 (“[LLDPE resins] are often blended with LDPE since the long branches enhance processing.”); EX1039 (**Briston, *Plastic Films*, 1989**), 14 (“wider die gap is required when extruding 100% LLDPE in order to prevent melt fracture”). Certain POSITA, for example, with a higher budget seeking a more durable film, would have therefore been motivated to prepare their heat shrinkable film by blending an amount of LLDPE resins with non-linear LDPE resins. Best’s films of non-linear LDPE resins blended with LLDPE resins would thus have been an obvious and commonplace choice for POSITA.

48. For POSITA, it would have been routine and obvious to make either of these two implementation choices (i.e., a film of non-linear LDPE resins either made without LLDPE resins or blended with LLDPE resins) under appropriate circumstances (as discussed in the preceding paragraphs), and clear either would work and provide the expected functionality of a heat shrinkable film that could be put into practical use for, e.g., a roof cover, and would yield predictable results of the film shrinking upon the application of heat, with reasonable expectation of success, when put in practical use for, e.g., a roof cover.

1. Express Disclosure of Heat Shrinkable Films Made of Non-Linear LDPE Including Shrinking Resins

49. Best discloses films of non-linear LDPE resins (both with and without LLDPE resins) including shrinking resins. For example, Best discloses that “[t]ypical industrial shrink films are formed in a single bubble blown extrusion process to a thickness of about 80 to 200 μm , and *provide shrinkage in two directions.*” EX1007 (**Best**), 21:17-21. Further, Best discloses that the main structural component of these “typical” industrial heat shrinkable films is “*high pressure, low density polyethylene (LDPE), often* blended with up to about 30 weight percent of linear low density polyethylene (LLDPE) to reduce problems of hole formation during shrinkage.” EX1007 (**Best**), 21:21-25. POSITA would have understood Best’s discussion of “typical” industrial heat shrinkable films made of LDPE and statement that they are “often” blended with LLDPE as a disclosure that typical industrial heat shrinkable films included films made both (1) of only non-linear LDPE resins (without any LLDPE resins) and (2) of blends of non-linear and linear LDPE resins (which results in a film of non-linear and linear low density polyethylenes).

50. Additional disclosures in Best of films of blends of resins that include both linear and non-linear LDPE resins include:

“polymer blend compositions composed of a blend of a *first linear low density polyethylene (LLDPE) copolymer and a second polyethylene polymer or copolymer.* The *first LLDPE* is a copolymer of ethylene

and at least one α -olefin having from 3 to about 20 carbon atoms which has a composition distribution breadth index (CDBI) of at least 70%, a melt index (MI), measured at 190° C. and 2.16 kg, of from about 0.1 to about 15 g/10 min, a density of from about 0.910 to about 0.945 g/cm³, and a molecular weight distribution (MWD) of from about 2.5 to about 5.5. The *second polyethylene polymer or copolymer blended with the first LLDPE* may be a very low density polyethylene (VLDPE), another linear or *non-linear low density polyethylene (LDPE)*, a medium density polyethylene (MDPE), a high density polyethylene (HDPE), a differentiated polyethylene (DPE), or combinations of the foregoing.”
E.g., EX1007 (**Best**), 1:61-2:9, 21:53-60, 21:61-22:12, 23:13-18; Tables 2, 3, 13, 15, 16, 17, 18, 21, 22, 23 (showing “shrink” properties of various resins including blends of linear and non-linear LDPE resins). POSITA would have understood the polyethylene polymers described in Best to be resins.

51. In my opinion POSITA would have understood that both the films of only non-linear low density polyethylene resins and the films of the blends of non-linear and linear LDPE, described in Best, include “shrinking resins.” Although “shrinking resins” is not a term used in Best, POSITA would have recognized Best’s description that these films, which are made of non-linear LDPE resins and “provide shrinkage” after processing, to be a disclosure of “shrinking resins.” EX1007 (**Best**), 21:17-21. Further, POSITA would have recognized Best’s teachings that its resins

and resin blends provide “improved shrink properties” to be a disclosure of “shrinking resins.” *E.g.*, EX1007 (**Best**), 23:13-23 (“[F]ilms containing the LLDPE polymers and blends described herein have improved shrink properties.”); EX1007 (**Best**), 21:53-60 (“The polymer blend [including non-linear LDPE] is particularly suitable for use as a film resin for heat-shrinkable films.”).

2. Inherency of “Shrinking Resins”

52. Even if “shrinking resins” is not explicitly disclosed in connection with Best’s disclosure of a heat shrinkable film of non-linear LDPE resins, at a minimum, POSITA would have understood that these polyethylene resins described in Best are “shrinking resins,” as used the term is used in claim 1 of the ’484 patent, because these resins provide the shrinking properties of the film after processing, as I explain above (*supra* ¶¶28-31, 51). Therefore, POSITA would have understood that films of non-linear LDPE resins (with and without LLDPE resins) that are heat shrinkable (as Best describes) are necessarily (and thus inherently) made of “shrinking resins” because creating polyethylene film that shrinks necessarily involves processing the polyethylene resins in a way that orients and stresses the molecules that make up the resins to provide the shrinking properties of the film when it is later heated (and this stress is released, thus shrinking the film) (*supra* ¶¶28-31). *See, e.g.*, EX1038 (**Rapra, Handbook of Plastic Films, 2003**), 42 (“Every blown polyethylene film is

shrinkable in the machine direction (MD), because it is normally stretched much more in this direction.”).

3. Obviousness of “Shrinking Resins”

53. Even if “shrinking resins” is not disclosed (expressly or inherently) in connection with Best’s disclosure of a heat shrinkable film of non-linear LDPE resins (with and without blended LLDPE resins), based on these same disclosures it would at minimum have been obvious to implement Best’s disclosures of heat shrinkable films of non-linear LDPE using shrinking resins (i.e., by processing the resins in a way that orients and stresses their molecules to provide the shrinking properties of the film when it is later heated), beneficially providing Best’s disclosed heat shrinkable properties to the films using a known and readily-implementable technique. This was a (indeed, *the*) known way to provide heat shrinkable properties to films of polyethylene (*see supra* ¶¶28-31), and would predictably provide the beneficial property of heat shrinkability, which would increase the ways in which the film could be used. Such heat shrinkable capabilities were already disclosed in Best itself. *E.g.*, EX1007 (**Best**), 21:7-9 (“Such films are capable of shrinking upon application of heat to release stress imparted to the film during or subsequent to extrusion.”). For POSITA, it would have been routine and obvious to include shrinking resins, and clear their inclusion would work and provide the expected functionality of a heat shrinkable film that could be put into practical use for, e.g., a roof

cover, and would yield predictable results of a film that shrinks upon the application of heat, with reasonable expectation of success, when put in practical use for, e.g., a roof cover.

C. Opinions Regarding Americover

1. Express Disclosure of Heat Shrinkable Film of LDPE Including Shrinking Resins

54. In my opinion, Americover (EX1021) discloses heat shrinkable films (e.g., “Heat Shrink Films”) of low density polyethylene including shrinking resins (e.g., the film “made using Low Density Polyethylene containing fractional melt virgin resins and other additives” and “shrinks in all directions” when heated; “biaxial shrinking process”; “will shrink 20-25%”).

55. For example, Americover discloses “Heat Shrink Films” “made using Low Density Polyethylene containing fractional melt virgin resins and other additives.” EX1021 (**Americover**), 1. Americover further discloses that “[w]hen the film is subjected to heat it begins a *biaxial shrinking process (shrinks in all directions)*.” EX1021 (**Americover**), 1.

56. Americover further discloses that its “formulations *will shrink 20-25%* of the original surface dimensions, allowing the film to mold itself to just about any structure” and that “[t]his tight fitting film forms a skin-like protective covering.” EX1021 (**Americover**), 1. Americover discloses that its film is used, for example, for covering building exteriors, for “protection from the elements,” for “hurricane

and storm damaged structures,” and for “buildings under construction,” and to “create[] weather-tight containments.” EX1021 (**Americover**), 1.

57. POSITA would have understood that Americover’s disclosures above (*see supra* ¶¶36, 54-56) including its discussion of its heat shrink film being “made using Low Density Polyethylene containing fractional melt virgin resins” to be a disclosure of heat shrinkable film of low density polyethylene including “shrinking resins.” POSITA would have understood that Americover’s disclosed “resins” are “shrinking resins,” given its teachings that its “formulations” provide the film with its shrinking properties, which shrinking properties POSITA would have understood were provided by the resins after processing (*see supra* ¶¶28-31, 55). *E.g.*, EX1021 (**Americover**), 1 (“Our formulations will shrink 20-25% of the original surface dimensions, allowing the film to mold itself to just about any structure. This tight fitting film forms a skin-like protective covering.”).

2. Obviousness of “Shrinking Resins”

58. Even if “shrinking resins” is not disclosed in Americover, based on these same disclosures it would at minimum have been obvious to implement Americover’s disclosures of heat shrinkable films using shrinking resins (i.e., by processing the resins in a way that orients and stresses their molecules to provide the shrinking properties of the film when it is later heated), beneficially providing Americover’s disclosed heat shrinkable properties to the films using a known and readily-

implementable technique. This was a (indeed, *the*) known way to provide heat shrinkable properties to films of low density polyethylene (*see supra* ¶¶28-31), and would predictably provide the beneficial property of heat shrinkability, which would increase the ways in which the film could be used. Such heat shrinkable capabilities were already disclosed in Americover itself. *E.g.*, EX1021 (**Americover**), 1 (“Our formulations will shrink 20-25% of the original surface dimensions, allowing the film to mold itself to just about any structure. This tight fitting film forms a skin-like protective covering.”). For POSITA, it would have been routine and obvious to include shrinking resins, and clear their inclusion would work and provide the expected functionality of a heat shrinkable film that could be put into practical use for, e.g., a roof cover, and would yield predictable results of a film that shrinks upon the application of heat, with reasonable expectation of success, when put in practical use for, e.g., a roof cover.

VII. CONCLUSION

59. Heat shrinkable films of low density polyethylene including shrinking resins were taught by the prior art, including by Best and Americover.

* * *

60. I reserve the right to supplement my opinions in the future to respond to any arguments that Stormseal or its expert(s) may raise and to take into account new information as it becomes available to me.

61. For example, I have been advised that any secondary considerations of non-obvious asserted by Stormseal are not pertinent to the specific analyses I am providing, and are being addressed by Structural Wrap elsewhere. To the extent Stormseal or its expert(s) raises secondary considerations relevant to my analyses, I reserve the right to supplement my opinions to respond.

62. I have been warned that willful false statements and the like are punishable by fine or imprisonment, or both. I make this declaration of my own personal knowledge, and all statements made of my own knowledge are true. All statements made on information and belief are believed to be true. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 25, 2023 at Roswell, Georgia.


Yash P. Khanna, Ph.D.

APPENDIX A

Yash P. Khanna

PROFESSIONAL EXPERIENCE

2009 – Present

Innoplast Solutions – President and Owner

- Consulting activities &/or In-House training courses at companies such as *PepsiCo*, *Eastman Chemical*, *Weyerhaeuser*, *Kimberly-Clark*, *Shaw Industries*, *Ballard Power*, *Beckman Coulter*, *Applied Minerals*, and *Owens-Corning* for Plastics related problems
- Consulting role at a “*Healthcare Companies*” addressing issues such as shelf-life and antimicrobial activity in Polymer & Plastics space.

2013- 2015

Applied Minerals – Chief Technology Officer

New York, NY

2005- 2009

IMERYS – Senior Technology Fellow/ Director of Technology

Roswell, GA

- Developed the most definitive understanding to date of CaCO_3 – Stearic Acid interactions since the 1960's leading to \$900K annual savings.
- Using minerals (CaCO_3 and Clays), developed modified products such as **Non-Wovens** and studied differentiation relative to the controls.

2001- 2004

Rayonier – Manager of Reinforced Engineered Plastics

Jessup, GA

- Led the project to a decision point. Fibers evaluated included wood fiber, wood flour, highly purified cellulose, kenaf, and rayon in comparison to glass fibers. Plastics evaluated included polypropylene (PP) and nylons (PA6 or N6).
- Developed a novel compounding process to achieve high dispersion at commercially acceptable throughputs

1975- 2001

AlliedSignal/ Honeywell – Research Group Leader/ Senior Principal Scientist

Morristown, NJ

- Demonstrated expertise in Thermal–Mechanical–Rheological–Barrier properties of materials.
- Uniquely skilled in demonstrating “*If & Why Product / Process A is Different from Product / Process B and Inventing Solutions to Match if not Reverse the Trend*” using a coordinated analytical sciences approach.
- Successfully solved numerous production, customer, and scale-up problems.
- Successfully solved manufacturing problems occurring during Injection Molding, Blow Molding, Thermoforming, Cast and Blown Film operations.

TECHNICAL EXPERIENCE

- **Nylons/ Polyamides**
 - Credited with “*Pioneering Work on Nylons*” (PA6, PA66, PA46, PA12, Amorphous Nylons)
 - Demonstrated expertise in structure-property-processing relationships: crystallinity, crystallite size, orientation, melt-rheology, dimensional stability, manufacturing problems.
- **Polymers/ Plastics**
 - Studied, published, and lectured on numerous polymers such as polyethylene (PE), PP, polyvinyl chloride (PVC), polyvinylidene chloride (PVdC), polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polystyrene (PS), polycarbonate (PC), fluoropolymers such as Teflon, PFA, PVdF, and PCTFE, and BIO-Polymers such as polyvinyl alcohol (PVOH) and polylactic acid (PLA) & its blends
- **Plastic Packaging Films**
 - Developed a “Paper-Like Film” from an R&D concept to respond to a need for an environmentally friendly packaging film.
 - R&T’s Business Unit Liaison to Specialty Films Business (1994-1995) and key technologist for Packaging Resins Business (1994-2001).
 - Led “Emerging Technologies” to improve Moisture and or Oxygen gas barrier of plastic films by modified Metallization and other coatings such as SiOx / AlOx via plasma enhanced chemical vapor deposition (PECVD), and E-beam vaporization. Evaluated other technologies of the future such as Polylactic acid (PLA) & its blends for packaging applications.
 - Continuously solved problems related to plastic films such as dimensional stability, optical properties, adhesive / cohesive failure, root-cause investigations of defects during retort operations, occurrence of gel defects, and bubble instability during blown film process.
- **Compounding & Additives**
 - Commercialized a cost-effective & high performance lubricant for Nylon plastics
 - Demonstrated skills in nucleating agents & clarifiers

- Experienced in detecting unexpected benefits of additives & developing new applications
- Experienced in “Specialty Compounding”

HONORS & AWARDS

- Research Publications > 120 {81 in Reviewed Journals, Books, and Encyclopedias}
- US Patents > 20
- Director of courses on Polymeric Films, Polymer Melt Rheology, Thermal Properties, and Analytical Sciences offered in the US and in Europe since 1995.
- Contributions to technology leveraged sales growth (>\$50M) recognized by Corporate R&T through 5 Special Recognition Awards and 3 business awards, namely, GROWTH, SAVE, and SALE of the year awards. (1991-1998)
- Recipient of the 1997 International “Mettler” award of the North American Thermal Analysis Society for outstanding contributions to thermoanalytical sciences. Society’s elected Fellow (1988).
- Recipient of the 2001 International “Engineering / Technology” award of the Society of Plastics Engineers for fundamental contributions to the field of plastics.

EDUCATION AND TRAINING

PH.D/ MS – Polymer Science & Engineering

The Polytechnic Institute of New York University – New York, NY

MS – Chemical Analysis & Process Control

IIT, Delhi

MS – Analytical Chemistry

University of Delhi

BS – Chemistry

University of Delhi

- Middle-Management and Leadership
- Total Quality Leadership – TQL/ TQS
- Six-Sigma Training & Implementation to Projects

List of Publications. Part I.

(Only in *Reviewed Journals, Books , or Encyclopedias*)

Year	#	Publication
1999	81	Pseudo Super-Miscibility: Blends of Semi-Crystalline Nylon Pairs Exhibiting a Single T _g and a Single T _m , <i>Polym. Eng. & Sci.</i> , 39(11), 2222, November (1999). Y.P. Khanna , N.S. Murthy, W.P. Kuhn, and E.D. Day
1997	80	Measurement of Crystalline Index in Nylons by DSC: Complexities and Recommendations, J. Polym. Sci., <i>Polym. Phys.</i> , 35, 2219 (1997). Y.P. Khanna and W.P. Kuhn
	79	Re-Examining the Oxygen Barrier of Nylon 6 Films. I . Role of Moisture and Processing Induced Variables, <i>J. Plastic Film & Sheeting</i> , 13, 197 (1997). Y.P. Khanna , E.D. Day, M.L. Tsai, and G. Vaidyanathan
1996	78	Thermal Characterization of Materials, Chapter 11, in “ <i>A Guide to Materials Characterization and Chemical Analysis</i> “ (J. P. Sibilis, editor, II nd edition), VCH Publishers, New York (1996). Y.P. Khanna
	77	Rheology and Molecular Weight of Polymers, Chapter 12, in “ <i>A Guide to Materials Characterization and Chemical Analysis</i> “ (J. P. Sibilis, editor, II nd edition), VCH Publishers, New York (1996). Y.P. Khanna , M.E. McDonnell, and P.K. Han
	76	New Developments in the Melt Rheology of Nylons. I: Effect of Moisture and Molecular Weight, <i>Polym. Eng. & Sci.</i> , 36(13), 1745 , July (1996). Y.P. Khanna , P.K. Han, and E.D. Day
1995	75	Memory Effects in Polymers. V. Processing History versus Thermally Induced Self-Orientation of Unoriented Poly(chlorotrifluoroethylene) Films, J. Polym. Sci., <i>Polym. Phys.</i> , 33, 1023 (1995). Y.P. Khanna , W.P. Kuhn, J.E. Macur, A.F. Messa, N.S. Murthy, A.C. Reimschuessel, R.L. Schneider, J.P. Sibilis, A.J. Signorelli, and T.J. Taylor
	74	Reliable Measurements of the Nylon 6 Glass Transition Made Possible by the New Dynamic DSC, <i>Macromolecules</i> , 28, 2644, (1995). Y.P. Khanna , W.P. Kuhn, and W.J. Sichina
	73	New Developments in the Melt Rheology of Nylons. I: Effect of Moisture and Molecular Weight, Proceedings of <i>Society of Plastics Engineers</i> (SPE) ANTEC, 1190 (1995). Y.P. Khanna , P.K. Han, and E.D. Day
1994	72	Flammability of Polymers, The <i>Encyclopedia of Advanced Materials</i> (D. Bloor, M.C. Flemings, R.J. Brook, S. Mahajan, and R.W. Cahn eds.), p.844, Pergamon Press, New York (1994).

		Y.P. Khanna
	71	The Mechanism of Action of Sugar Acetals as Nucleating Agents for Polypropylene, <i>Macromolecules</i> , 27, 3147 (1994). T.L. Smith, D.Masilamani, L.K. Bui, Y.P. Khanna , R.G. Bray, W.B. Hammond, S. Curran, J.J. Belles, and S.B. Castelli.
	70	Crystallinities of Poly(chlorotrifluoroethylene) and its Copolymers by Differential Scanning Calorimetry, X-Ray Diffraction, and Density Measurements, <i>Polym. Eng. & Sci.</i> , 36(16), 1254, August 1994. N.S. Murthy, Y.P. Khanna , and A.J. Signorelli
	69	Acetals as Nucleating Agents for Polypropylene, <i>J. Appl. Polym. Sci.</i> , 52, 591 (1994). T.L. Smith, D. Masilamani, L.K. Bui, R. Brambilla, Y.P. Khanna , and K.A. Gabriel
1993	68	Transformations between Polyiodide Structures in a Nylon 6 Matrix, Chemistry of <i>Materials</i> - ACS Publication, 5, 672 (1993). N.S. Murthy and Y.P. Khanna
	67	Rheological Mechanism and Overview of Nucleated Crystallization Kinetics, <i>Macromolecules</i> , 26, 3639 (1993). Y.P. Khanna
	66	Dynamic Melt Rheology.II. Re-examining the Relationship of G' in Oscillatory Rheometry to the Melt Elasticity, <i>Polym. Eng. & Sci.</i> , 33(2), 122 January (1993). Y.P. Khanna and K.R. Slusarz
1992	65	Overview of Transition Phenomenon in Nylon 6, <i>Macromolecules</i> , 25, 3298 (1992). Y.P. Khanna
1991	64	Dynamic Melt Rheology.I. Re-examining Dynamic Viscosity in Relationship to the Steady Shear Flow Viscosity, <i>Polym. Eng. & Sci.</i> , 31(6), 440, March (1991). Y.P. Khanna
	63	Dynamic Mechanical Analysis of Fibers.II. Estimation of Fiber Orientation and Characterization of Heat Set PET Yarns, <i>J. Appl. Polym. Sci.</i> , 42, 693 (1991) Y.P. Khanna , T.J. Taylor, and R. Kumar
	62	The Glass Transition and Molecular Motions of Poly(chlorotrifluoroethylene), <i>Polymer</i> , 32(11), 2010 (1991). Y.P. Khanna and R. Kumar

1990	61	A Barometer of Crystallization Rates of Polymeric Materials, <i>Polym. Eng. & Sci.</i> , 30(24), 1615, December (1990) Y.P. Khanna
	60	Evaluation of Thermal History of Polymeric Films and Fibers Using DSC / TMA / DMA Techniques, <i>J. Appl. Polym. Sci.</i> , 40, 569 (1990). Y.P. Khanna
	59	A New Approach to Monitor Liquid Permeability through Plastic Containers, <i>J. Appl. Polym. Sci.</i> , 41, 435 (1990). Y.P. Khanna and T.J. Taylor
	58	Observation of a New High Temperature Transition in Polytetrafluoroethylene, <i>Macromolecules</i> , 23, 2488, (1990). Y.P. Khanna , G. Chomyn, R. Kumar, N.S. Murthy, K.P. O'Brien, and A.C. Reimschuessel
	57	Phenolic Triazine (PT) Resins.II. Cure Characterization by Dynamic Melt Rheology and its Comparison to DSC, <i>Polym. Eng. & Sci.</i> , 30(18), 1171, September (1990). Y.P. Khanna , R. Kumar, and S. Das
	56	Gelation and Vittrification of Thermoset Resins by Calorimetric / Mechanical / Rheological Techniques, Proceedings of <i>Society of Plastics Engineers(SPE) ANTEC</i> , 904 (1990). Y.P. Khanna , R. Kumar, and S. Das
	55	A New High Temperature Morphology in Polytetrafluoroethylene, Proceedings of <i>Society of Plastics Engineers(SPE) ANTEC</i> , 996 (1990). Y.P. Khanna , R. Kumar, and A.C. Reimschuessel
1989	54	The Glass Transition of Cu ₇₈ Ni ₆ Sn ₉ Amorphous Alloy Ribbon, <i>J. Matl. Sci. Letters</i> , 8, 1165 (1989). T.J. Taylor, Y.P. Khanna , R. Kumar, and H.H. Liebermann
	53	Phenolic Triazine (PT) Resins.I. Gelation Phenomenon Studied by Calorimetric, Mechanical, and Dielectric Techniques, <i>Polym. Eng. & Sci.</i> , 29(20), 1488, October (1989). Y.P. Khanna , R. Kumar, and S. Das
	52	Dynamic Mechanical Analysis of Fibers.I. Effect of Experimental Variables and Material Type, <i>J. Appl. Polym. Sci.</i> , 38, 571 (1989). Y.P. Khanna , W.M. Wenner, R. Kumar, and S. Kavesb
	51	Calibration and Accuracy of Thermal Mechanical Analyzers, <i>Thermochimica Acta</i> , 149, 215 (1989). T.J. Taylor and Y.P. Khanna

	50	Influence of the Low and High Molecular Weight Species on the Rheological Behavior of Polyethylenes, Proceedings of <i>Society of Plastics Engineers(SPE)</i> ANTEC, 1676 (1989). R. Kumar and Y.P. Khanna
	49	Processing Induced Memory Effects in Polymers.I. Effect on Product Behavior, Proceedings of <i>Society of Plastics Engineers(SPE)</i> ANTEC, 681 (1989). Y.P. Khanna, R. Kumar, and A.C. Reimschuessel
	48	Processing Induced Memory Effects in Polymers.I. Origin of Memory Effect, Proceedings of <i>Society of Plastics Engineers(SPE)</i> ANTEC, 685 (1989). Y.P. Khanna, R. Kumar, and A.C. Reimschuessel
	47	Dielectric Properties of Halar, an Alternating Copolymer of Ethylene and Chlorotrifluoroethylene, <i>J. Appl. Polym. Sci.</i> , 38, 135 (1989). Y.P. Khanna, T.J. Taylor, and S. Chanrasekaran
	46	Estimation of Polymer Crystallinity by Dynamic Mechanical Techniques, <i>J. Appl. Polym. Sci.</i> , 37, 2719 (1989). Y.P. Khanna
	45	Annealing of Polymers in the Solid-Melt Region.I. A New Approach to Estimate the Equilibrium Melting Temperature of Polymer Crystals, <i>J. Polym. Sci., Polym. Phys.</i> , 27, 369 (1989). Y.P. Khanna and R. Kumar
1988	44	Thermal Analysis, Chapter 9, in “ <i>A Guide to Materials Characterization and Chemical Analysis</i> “ (J. P. Sibilis, editor, 1st edition), VCH Publishers, New York (1988). E.A. Turi, Y.P. Khanna, T.J. Taylor
	43	Memory Effects in Polymers.IV. Processing History vs Crystallization Rate-Effect of Polymer Structure, , <i>Polym. Eng. & Sci.</i> , 28(24), 1612, December (1988). Y.P. Khanna, R. Kumar, and A.C. Reimschuessel
	42	Memory Effects in Polymers.III. Processing History vs Crystallization Rate of Nylon 6-Comments on the Origin of Memory Effect, , <i>Polym. Eng. & Sci.</i> , 28(24), 1607, December (1988). Y.P. Khanna, R. Kumar, and A.C. Reimschuessel
	41	Memory Effects in Polymers.II. Processing History vs Crystallization Rate-Observation of Phenomenon and Product Behavior, , <i>Polym. Eng. & Sci.</i> , 28(24), 1600, December (1988). Y.P. Khanna, A.C. Reimschuessel, A. Banerjee, and C. Altman

40	A New Differential Scanning Calorimetry Based Approach for the Estimation of Thermal Conductivity of Polymer Solids and Melts, <i>Polym. Eng. & Sci.</i> , 28(16), 1034, August (1988). Y.P. Khanna, T.J. Taylor, and G. Chomyn
39	The Melting Temperature of Polytetrafluoroethylene, <i>J. Matl. Sci. Letters</i> , 7, 817 (1988). Y.P. Khanna
38	Applications of Thermal Analysis Based Physico-Chemical Kinetics in Polymer Science and Engineering, The <i>Arabian J. Sci. & Eng.</i> , 13(4), 557 October (1988). Y.P. Khanna , T.J. Taylor, and R. Kumar
37	Comments and Recommendations on the Use of the Avrami Equation for Physico-Chemical Kinetics, <i>Polym. Eng. & Sci.</i> , 28(16), 1042, August (1988). Y.P. Khanna and T.J. Taylor
36	The Distinguishability of Kinetic Models Using a Single, Non-Isothermal Thermal Analysis Experiment, <i>Thermochimica. Acta</i> , 136, 219 (1988). T.J. Taylor and Y. P. Khanna
35	A Multidisciplinary Approach to Problem Solving in the Plastics Industry, Proceedings of <i>Society of Plastics Engineers</i> (SPE) ANTEC, (1988). J.P. Sibilis, Y.P. Khanna , R.G. Bray, J.E. Macur, and K.P. O'Brien
34	Characterization of Amorphous Alloys by Thermal Analysis Techniques, <i>J. Matl. Sci.</i> , 23, 2613 (1988). T.J. Taylor, Y.P. Khanna , and H.H. Liebermann
33	Dynamic Mechanical and Dielectric Relaxations in Polyethylene Waxes, <i>Polym. Comm.</i> , 29, 240, August (1988). Y.P. Khanna , W.M. Wenner, and L. Krutzel
32	Memory Effects in Polymers.I. Orientational Memory in the Molten State; Its Relationship to Polymer Structure and Influence on Recrystallization Rate and Morphology, <i>J. Appl., Polym. Sci.</i> , 35, 2259 (1988). Y.P. Khanna and A.C. Reimschuessel
31	Amorphous Phase Segregation in Polyethylene-Based Ionomers, <i>Macromolecules</i> , 21, 268 (1988). Y.P. Khanna , W.M. Wenner, and L. Krutzel

1987	30	Thermal Properties and the Structural Relaxation of Fe ₇₈ B ₁₃ Si ₉ Amorphous Alloy Ribbon, <i>J. Non-Cryst. Solids</i> , 94, 209 (1987). R.J.J. Martis, T.J. Taylor, and Y.P. Khanna
	29	The Mechanism of the Solid State Phase Transitions in the Polydiacetylene, Poly-4BCMU: Thermal, X-ray Diffraction, and Raman Scattering Studies, <i>J. Phys. C: Solid State Phys.</i> 20, 4283 (1987). Z. Iqbal, N.S. Murthy, Y.P. Khanna , J.S. Szobota, R.A. Dalterio, and F.J. Owens
	28	Practical Aspects of Physicochemical Kinetics using Thermal Techniques, , <i>Polym. Eng. & Sci.</i> , 27(10), 764, May (1987). Y.P. Khanna and T.J. Taylor
1986	27	On the Question of Metallic and Superconducting Poly(carbon diselenide), <i>J. Chem. Phys.</i> , 85(7), 4019 (1986). Z. Iqbal, Y.P. Khanna , N.S. Murthy, J.S. Szobota, C. Maleysson, R.H. Baughman, Y. Okamoto, and L.S. Choi
	26	Molecular Relaxations in Halar, an Alternating Copolymer of Ethylene and Chlorotrifluoroethylene, <i>Macromolecules</i> , 19, 2426 (1986). Y.P. Khanna , J.P. Sibilis, and S. Chandrasekaran
	25	Aromatic Polyamides VII. Molecular Weight Effects on Thermal Properties, <i>J. Polym. Sci., Polym. Chem.</i> , 24, 2377 (1986). Y.P. Khanna and E. M. Pearce
1985	24	Flammability of Polymers, Applied Polymer Science (IInd edition, R.W. Tess and G.W. Poehlein, editors), <i>ACS Symposium Series-285</i> , Chapter 14, 305 (1985). Y.P. Khanna and E.M. Pearce
	23	Dynamic Mechanical Thermal Analysis of Polycarbonate and Polyester Carbonate, <i>J. Therm. Anal.</i> , 30, 153 (1985). Y.P. Khanna
	22	Dynamic Mechanical Relaxations in Polyethylene, <i>Macromolecules</i> , 18, 1302 (1985). Y.P. Khanna , E.A. Turi, T.J. Taylor, V.V. Vickroy, and R.F. Abbott
1984	21	High Temperature Aging of Halar Film.I. Study of Physicochemical Changes, <i>J. Appl. Polym. Sci.</i> , 29, 3607 (1984). Y.P. Khanna , E.A. Turi, and J.P. Sibilis

	20	High Temperature Aging of Halar Film.II. Analysis of Melting Behavior, <i>J. Appl. Polym. Sci.</i> , 29, 2175 (1984). Y.P. Khanna , E.A. Turi, and J.P. Sibilis
1983	19	Aromatic Polyamides.VIII. Kinetic Analysis of the Thermal and Thermo-oxidative Degradation, <i>J. Therm. Anal.</i> , 26, 107 (1983). Y.P. Khanna and E.M. Pearce
1982	18	Aromatic Polyamides.VI. Thermal Behavior of Model Diamides, <i>J. Appl. Polym. Sci.</i> , 27, 2301 (1982) Y.P. Khanna , E.M. Pearce, and D.A. Vernick
	17	Aromatic Polyamides.V. Substituent Effect on Thermal Properties, <i>J. Appl. Polym. Sci.</i> , 27, 2053 (1982). Y.P. Khanna and E.M. Pearce
	16	Aromatic Polyamides.IV. Configurational Analysis of Poly(chloro-2,4-phenylene isophthalamide) by NMR, J. Polym. Sci., <i>Polym. Chem.</i> , 20, 253 (1982). Y.P. Khanna , E.M. Pearce, and G.E. Babbitt
	15	One-Dimensional Order / Disorder in a Polydiacetylene, J. Polym. Sci., <i>Polym. Phys.</i> , 20, 1029 (1982). G.N. Patel and Y.P. Khanna
1981	14	Aromatic Polyamides.III. Mechanistic Studies on the Role of Substituent Chlorine in Flame Retarding Aromatic Polyamides, J. Polym. Sci., <i>Polym. Chem.</i> , 19, 2835 (1981). Y.P. Khanna , and E.M. Pearce
	13	Aromatic Polyamides.II. Thermal Degradation of Some Aromatic Polyamides and Their Model Diamides, J. Polym. Sci., <i>Polym. Chem.</i> , 19, 2817 (1981). Y.P. Khanna , E.M. Pearce, J.S. Smith, D.T. Burkitt, H. Njuguna, D.M. Hindenlang, and B.D. Forman
	12	Aromatic Polyamides.I. Synthesis and Characterization of Some Aromatic Polyamides and Their Model Diamides, J. Polym. Sci., <i>Polym. Chem.</i> , 19, 2799 (1981). Y.P. Khanna , E.M. Pearce, B.D. Forman, and D.A. Bini
	11	Thermal Analysis in Polymer Flammability, Chapter 8 in “ <i>Thermal Characterization of Polymeric Materials</i> “ (E.A. Turi, editor), Academic Press, New York (1981). E.M. Pearce, Y.P. Khanna , and D. Raucher

	10	Effect of Diethylene Glycol Content of Polyethylene Terephthalate on its Thermal Transitions, pp. 60-78, in “ <i>Thermal Characterization of Polymeric Materials</i> “ (E.A. Turi, editor), (1981). E.A. Turi, Y.P. Khanna , and J.A. Bander
	9	Retention of a Foaming Agent in Poly(vinyl chloride)(PVC) and Chlorinated PVC, <i>Polym. Eng. & Sci.</i> , 21(4), 185 (1981). Y.P. Khanna , E.A. Turi, and J.P. Sibilis
1980	8	Abrupt Dissolution of Polydiacetylenes, J. Polym. Sci., <i>Polym. Phys.</i> , 18, 2209 (1980). G.N. Patel and Y.P. Khanna
	7	Thermochromism in Polydiacetylene Solutions, J. Polym. Sci., <i>Polym. Phys.</i> , 18, 1383 (1980). G.N. Patel, J.D. Witt, and Y.P. Khanna
1979	6	Polymer Conversions in the -ray Polymerization of Urethane-Substituted Diacetylenes, , J. Polym. Sci., <i>Polym. Phys.</i> , 17, 899 (1979). G.N. Patel, Y.P. Khanna , D.M. Ivory, J.M. Sowa, and R.R. Chance
1978	5	Energetics and Mechanism of the Solid-State Polymerization of Diacetylenes, <i>J. Am. Chem. Soc.</i> , 100, 6644 (1978). G.N. Patel, R.R. Chance, E.A. Turi, and Y.P. Khanna
	4	Energetics of the Thermal Polymerization of a Diacetylene Crystal, <i>J. Am. Chem. Soc.</i> , 100, 1307 (1978). R.R. Chance, G.N. Patel, E.A. Turi, and Y.P. Khanna
	3	Synergism and Flame Retardancy, Chapter 2 in “ Flame-Retardant Polymeric Materials ”(vol. 2, M. Lewin, S.M. Atlas, and E.M. Pearce, editors), Plenum Press, New York (1978). Y.P. Khanna and E. M. Pearce
1977	2	Development of a Middle Endotherm in DSC Thermograms of Thermally Treated Drawn PET Yarns and its Structural and Mechanistic Interpretation, <i>J. Macromol. Sci.- Phys.</i> , B13(2), 231 (1977). H.J. Oswald, E.A. Turi, P.J. Harget, and Y.P. Khanna
1976	1	Copolymerization of Styrene with Vinyltriethoxysilane and Vinyltriacetoxysilane, J. Polym. Sci., <i>Polym. Chem.</i> , 14, 465 (1976). P. Bajaj, Y.P. Khanna , and G.N. Babu

List of Publications, Part II.
(Non-Reviewed & Presented)

Year	#	Publication
2003	39	“High Purity Wood Fiber based Thermoplastic Composites”, Proceedings of the ACS Meeting, New Orleans, March (2003). Y. P. Khanna et.al.,
1998	38	“Re-Examining the Oxygen Barrier of Nylon 6 Films. II. Role of Protective Layers on the Barrier of Moisture Sensitive Polymers” Proceedings of the 15th International Schroeder Conference on Packaging Innovations, Chicago, November 11-12 (1998) Y.P.Khanna, E.Day, and M.L.Tsai
1997	37	“Evolution of Technology from Routine Analytical Testing” Mettler Award Address, Proceedings of the 25th North American Thermal Analysis Society (NATAS) Conference, McLean, VA, USA, p1, September 7-9 (1997) Y. P. Khanna
1996	36	“New Understanding of the Oxygen Barrier of Nylon 6 in Packaging Applications” Proceedings of the 13th International Schroeder Conference on Packaging Innovations, Chicago, November 20-21 (1996) Y.P.Khanna, E.Day, M.Tsai, R.Bray, N.Vasanthan, and G. Vaidyanathan
1994	35	“Reliable Measurements of Nylon Tg vs Moisture by DDSC” Proceedings of the 23rd North American Thermal Analysis Society (NATAS) Conference, Toronto, <i>Canada</i> , p11, September 25-28 (1994) Y.P.Khanna, W.P.Kuhn, and W.J.Sichina
	34	“Peculiar Dimensional Behavior of Poly(CTFE)” Proceedings of the 23rd North American Thermal Analysis Society (NATAS) Conference, Toronto, p223, September 25-28 (1994) Y.P.Khanna and W.P.Kuhn
1993	33	“Study of Crystallization Kinetics by DSC and Parallel Plate Rheometry.” Proceedings of the Japanese Thermal Analysis Society Meeting, Nagaoka, <i>Japan</i> , October (1993) Y.P.Khanna
	32	“Crystallinity of Poly(chlorotrifluoroethylene) by Conventional and Oscillatory DSC” Proceedings of the 22nd North American Thermal Analysis Society (NATAS) Conference, Denver, p391, September 19-22 (1993) Y.P.Khanna
	31	“Crystallization Kinetics by Parallel Plate Rheometry and its Comparison to DSC” Proceedings of the 22nd North American Thermal Analysis Society (NATAS) Conference, Denver, p484, September 19-22 (1993) Y.P.Khanna
1991	30	“Product and Process Development Through Analytical Research” Lecture on January 4 in Poona, <i>India</i> , published in Polymer Science-Contemporary Themes, Vol II (S.Sivaram, editor), Tata McGraw-Hill, New Delhi (1991). Y.P.Khanna
	29	“Resolving Polymer Transitions and Crystallinity by DMA” Proceedings of the 20th North American Thermal Analysis Society (NATAS) Conference, <i>USA</i> , September 19-22 (1991) Y.P.Khanna

		Minneapolis, p150, September 22-25 (1991). Y.P.Khanna
	28	“Oscillatory Rheometry I. What Exactly is Dynamic Viscosity” Proceedings of the 20th North American Thermal Analysis Society (NATAS) Conference, Minneapolis, p515, September 22-25 (1991) Y.P.Khanna and K.R. Slusarz
	27	“Oscillatory Rheometry II. What Exactly is the Elastic Component” Proceedings of the 20th North American Thermal Analysis Society (NATAS) Conference, Minneapolis, p516, September 22-25 (1991) Y.P.Khanna and K.R. Slusarz
1990	26	“A New High Temperature Morphology in Polytetrafluoroethylene” Proceedings of the 19th North American Thermal Analysis Society (NATAS) Conference, Boston, p185, September 23-26 (1990) Y.P.Khanna
	25	“Clarification of a Tg of a Polymer in Not So Straight-Forward Situations” Proceedings of the 19th North American Thermal Analysis Society (NATAS) Conference, Boston, p188, September 23-26 (1990) Y.P.Khanna
	24	“A Barometer of Crystallization Rates of Polymeric Materials” Proceedings of the 19th North American Thermal Analysis Society (NATAS) Conference, Boston, p189, September 23-26 (1990) Y.P.Khanna
	23	“Study of Cure Kinetics by Dynamic Melt Rheology” Proceedings of the 19th North American Thermal Analysis Society (NATAS) Conference, Boston, p380, September 23-26 (1990) Y.P.Khanna
1989	22	“Thermal History of Polymeric Films and Fibers I: Use of DSC, TMA, and DMA” Proceedings of the 18th North American Thermal Analysis Society (NATAS) Conference, San Diego, p422-424, September 25-27 (1989) Y.P.Khanna
	21	“Thermal History of Polymeric Films and Fibers II: Relationship to Morphology” Proceedings of the 18th North American Thermal Analysis Society (NATAS) Conference, San Diego, p426-427, September 25-27 (1989) Y.P.Khanna
	20	“Dynamic Mechanical Analysis of Fibers I: Effect of Experimental Conditions” Proceedings of the 18th North American Thermal Analysis Society (NATAS) Conference, San Diego, p783-785, September 25-27 (1989) Y.P.Khanna
	19	“Dynamic Mechanical Analysis of Fibers II: Experimental Conditions vs Morphological Information” Proceedings of the 18th North American Thermal Analysis Society (NATAS) Conference, San Diego, p787-788, September 25-27 (1989) Y.P.Khanna , R. Kumar, and W.M. Wenner
1988	18	“Memory Effects in Polymers Studied by Thermal and Complementary Techniques I. Orientational Memory” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p.35-36, October 10-12 (1988) Y.P.Khanna , and A.C. Reimschuessel

	17	“Memory Effects in Polymers Studied by Thermal and Complementary Techniques II. Processing Induced Memory” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p37-38, October 10-12 (1988) Y.P.Khanna , R.Kumar and A.C.Reimschuessel
	16	“Memory Effects in Polymers Studied by Thermal and Complementary Techniques III. Origin and Relationship to Polymer Structure” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p39, October 10-12 (1988) Y.P.Khanna , R.Kumar, and A.C. Reimschuessel
	15	“Gelation Phenomenon Studied by Calorimetric, Mechanical, and Dielectric Techniques” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p187, October 10-12 (1988) Y.P.Khanna , R.Kumar, and S. Das
	14	“Estimation of Polymer Crystallinity by Dynamic Mechanical Techniques” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p200-201, October 10-12 (1988) Y.P. Khanna
	13	“A New Computer Assisted Approach to Estimate the Equilibrium Melting Temperature of Polymer Crystals” Proceedings of the 17th North American Thermal Analysis Society (NATAS) Conference, Orlando, p688-689, October 10-12 (1988) Y.P.Khanna
1986	12	“Molecular Motions in Halar Studied by Thermal and Mechanical Techniques” Proceedings of the 15th North American Thermal Analysis Society (NATAS) Conference, Cincinnati, p125, September 21-24 (1986) Y.P.Khanna , J.P.Sibilia, and S. Chandrasekaran
	11	“Crystallization of Halar from the Molten State-Complexities Observed in DSC Technique” Proceedings of the 15th North American Thermal Analysis Society (NATAS) Conference, Cincinnati, p501, September 21-24 (1986) Y.P.Khanna
	10	“Preliminary Information on Polymer Melt Behavior Using DMA” Proceedings of the 15th North American Thermal Analysis Society (NATAS) Conference, Cincinnati, p500, September 21-24 (1986) Y.P.Khanna
1985	9	“Determining Heat Setting History of Fibers by Thermal Techniques” American Chemical Society (ACS) Polymer Preprints, Miami, 26(1),8(1985) E.A. Turi and Y.P.Khanna
	8	“Stability of Acceptor-Doped Polyacetylene” The Electrochemical Society, Extended Abstracts, 85(1), Abstract #82, Toronto, May 12-17(1985) R.L. Elsenbaumer, G.G. Miller, Y.P.Khanna , E. McCarthy, and R.H. Baughman
1984	7	“Dynamic Mechanical Relaxations in Polyethylene” Proceedings of the 13th North American Thermal Analysis Society (NATAS) Conference, Philadelphia, p550, September 23-26 (1984) Y.P.Khanna , E.A. Turi, and T.J. Taylor
	6	“Processing Induced Copolymerization of Nylon 6 and Nylon 66 Homopolymers” American Chemical Society (ACS) Polymer Preprints, Miami, 26(1),8(1985) E.A. Turi and Y.P.Khanna

		Philadelphia, 25(2),98-99 (1984) Y.P. Khanna and E.A. Turi
1981	5	“Kinetic Analysis of the Thermal and Thermooxidative Degradation of Some Aromatic Polyamides” Proceedings of the 11th North American Thermal Analysis Society (NATAS) Conference, New Orleans, p467, October 18-21 (1981) Y.P.Khanna , and E.M.Pearce
1980	4	“Thermal Degradation and Flammability Behavior of Chlorine Containing Aromatic Polyamides” American Chemical Society (ACS) Polymer Preprints, Las Vegas Meeting, 43, 94-96 (1980) Y.P.Khanna and E.M.Pearce
	3	“Analysis of the Degradation Products of Aromatic Polyamides by Pyrolysis Gas Chromatography” Pittsburgh Conference Abstracts, Atlantic City, p294, March 10-14 (1980) D. Burkitt and Y.P.Khanna
1979	2	“Thermal Analysis of the Thermochromic Phase Change in a Polydiacetylene” American Chemical Society (ACS) Polymer Preprints, Washington, D.C. Meeting, 20(2), 457-462, September (1979) Y.P. Khanna and G.N. Patel
	1	“Retention of a Foaming Agent in PVC and Chlorinated PVC” American Chemical Society (ACS) Polymer Preprints, Washington, D.C. Meeting, 20(2), 457-462, September (1979) Y.P. Khanna , E.A. Turi, and J.P. Sibilis

List of Patents

(US Patents only)

21. “Cellulose Fiber Reinforced Composites Having Reduced Discoloration and Improved Dispersion and Associated Methods of Manufacture”
US Pat. 6,743,507 (2004)
Y.P. Khanna, F. Barlow, Daren B. Pietsch, J. Underwood
20. “Highly Oriented Fluoropolymer Films”
US Pat. 6,465,103 (2003)
M. L. Tsai, **Y. P. Khanna**, J. E. Mackey
19. “Highly Oriented Fluoropolymer Films”
US Pat. 6,238,607 (2001)
M. L. Tsai, **Y. P. Khanna**, R. Schneider, J. E. Mackey
18. “Nylon 6 or Nylon 66 Based Compositions and Films Formed Therefrom Having Reduced Curl”
US Pat. 6,040,392 (2000)
Y. P. Khanna, F. Puterbaugh, W. P. Kuhn, M. J. Schena
17. “Biaxial Orientation of Fluoropolymer Films”
US Pat. 5,945,221 (1999)
M. L. Tsai, **Y. P. Khanna**, J. E. Mackey
16. “Highly Oriented Fluoropolymer Films”
US Pat. 5,874,035 (1999)
M. L. Tsai, **Y. P. Khanna**, J. E. Mackey
15. “Process for Improving the Properties of Polymers”
US Pat. 5,496,918 (1996)
Y. P. Khanna, K. R. Slusarz, M. K. Gabriel, A. C. Reimschuessel
14. “Blow Molding Polyamide Compositions”
US Pat. 5,403,896 (1995)
Y. P. Khanna, R. Kumar, J. P. Sibia
13. “Nucleating System for Poly(chlorotrifluoroethylene) and Articles Formed Therefrom”
US Pat 5,310,775 (1994)
J. P. Sibia, **Y. P. Khanna**, A. J. Signorelli, D. A. Roberts

12. "Process for Improving the Properties of Polymers"
US Pat. 5,324,816 (1994)
Y. P. Khanna, A. Banerjee, J. J. Belles, Jr., A. C. Reimschuessel
11. "Polyolefins Containing Polyol Nucleating Agent and Articles Formed Therefrom"
US Pat. 5,216,051 (1993)
T. L. Smith, J. R. Schollmeyer, **Y. P. Khanna**, K. A. Miller, D. Masilamani
10. "Polyolefins containing Polyester Nucleating Agent and Articles Formed Therefrom"
US Pat. 5,137,973 (1992)
Y. P. Khanna, K. R. Slusarz, G. Chomyn, T. L. Smith
9. "Process for Improving the Properties of Polytetrafluoroethylene"
US Pat. 5,122,592 (1992)
Y. P. Khanna, G. Chomyn, R. Kumar, A. C. Reimschuessel
8. "Process for Improving the Properties of Polymers"
US Pat. 5,091,508 (1991)
Y. P. Khanna, A. C. Reimschuessel
7. "Process for Enhancing the Compatibility of Polyamide and Polyester in Blends"
US Pat. 5,055,509 (1991)
H. R. Bhattacharjee, **Y. P. Khanna** , R. Kumar, J. J. Belles, Jr.
6. "Process for Production of Quasi-Random Copolymers from Homopolymers Using Aryl Phosphoryl Azide(s)"
US Pat 4,946,909 (1990)
H. R. Bhattacharjee, **Y. P. Khanna**
5. "Process for Increasing the Melt Viscosity and/or Melt Elasticity of Polyamides with Aryl Phosphoryl Azide"
US Pat. 4,906,708 (1990)
H. R. Bhattacharjee, **Y. P. Khanna**
4. "Method of Blow Molding Polyamides"
US Pat. 4,876,127 (1989)
Y. P. Khanna, H. R. Bhattacharjee, R. Kumar, J. I. Williams, J. P. Sibilis
3. "Process for Production of Quasi-Random Copolymers from Homopolymers"
US Pat. 4,861,838 (1989)
Y. P. Khanna
2. "Nucleating System for Polyamides"
US Pat. 4,749,736 (1988)

Y. P. Khanna, G. Chomyn, A. Banerjee, A. C. Reimschuessel

1. “Quasi-Random Copolymers from Homopolymers”

US Pat. 4,417,032 (1983)

Y. P. Khanna, E. A. Turi, S. M. Aharoni and T. Largman

APPENDIX B

Exhibit	Description
EX1001	U.S. Patent No. 11,168,484
EX1002	U.S. Patent No. 11,168,484 File History
EX1007	U.S. Patent No. 7,951,873 (“Best”)
EX1009	U.S. Patent No. 6,425,213 (“Lachapelle”)
EX1010	U.S. Patent No. 7,517,941 (“Myhre”)
EX1021	Americover Heat Shrink Wrap Webpage (“Americover”)
EX1032	WO 2004/022646 (“Ohlsson”)
EX1033	U.S. Patent No. 4,247,509 (“Talbot 509”)
EX1034	U.S. Patent No. 4,763,783 (“Talbot 783”)
EX1038	Rapra Technology Limited, <i>Handbook of Plastic Films</i> (2003) (“Rapra”)
EX1039	John H. Briston, <i>Plastic Films</i> , Third Edition (1989) (“Briston”)
EX1047	John H. Briston, <i>Plastic Films</i> , Third Edition (1989) (1990 Reprint)