

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	SUN, Dazhu, <i>et al.</i>	§	Art Unit:	1762
		§		
		§		
Serial No.:	12/698,602	§		
		§	Examiner:	NERANGIS, Vickey M.
Filed:	Feb. 02, 2010	§		
		§		
For:	Isolated Nanotubes and	§		
	Polymer Nanocomposites.	§	Confirmation No.:	4312

AMENDMENT AND RESPONSE TO OFFICE ACTION DATED MAY 30, 2012

Atty. Dkt. No. 2238-04301
Customer No. 23505
Date: November 8, 2012

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants acknowledge receipt of the non-final Office Action dated May 30, 2012, and in reply submit the following amendments and remarks.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A nanocomposite, comprising:
a medium, wherein the medium comprises a matrix; and
a nanofiller, ~~wherein the nanofiller comprises consisting essentially of~~ at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium.
2. (Currently Amended) The nanocomposite of claim 1, wherein the medium is selected from the group consisting of epoxies, plastics, polymers, thermosets, thermoplastics, and combinations thereof.
3. (Cancelled).
4. (Currently Amended) The nanocomposite of ~~claim 3~~claim 1, wherein the nanoplatelet comprises a material selected from the group consisting of clay, nanoclay, graphite, inorganic crystal, organic crystal, and combinations thereof.
5. (Currently Amended) The nanocomposite of ~~claim 3~~claim 1, wherein the at least one exfoliated nanotube comprises a carbon nanotube.
6. (Original) The nanocomposite of claim 5, wherein the carbon nanotube comprises at least one selected from the group consisting of multi-walled carbon nanotubes, single walled carbon nanotubes, and combinations thereof.
7. (Original) The nanocomposite of claim 4, wherein the at least one exfoliated nanotube is reversibly associated with at least one nanoplatelet
8. (Original) The nanocomposite of claim 6, further comprising a nanoplatelet-to-nanotube mass ratio of at least 0.5:1.

9-12. (Cancelled).

13. (Withdrawn) A process for manufacturing a nanocomposite, comprising:

- a) adding at least one nanotube to a first solution, wherein the first solution functionalizes the nanotube;
- b) isolating the nanotube from the first solution and resuspending the nanotube in an aqueous solvent to form a functionalized nanotube solution;
- c) adding at least one nanoplatelet to a second solution, wherein the second solution exfoliates the nanoplatelet, to form an exfoliated nanoplatelet solution;
- d) admixing the functionalized nanotube solution and exfoliated nanoplatelet solution to form a nanofiller solution;
- e) drying the nanofiller solution the mixture to form a powder;
- f) resuspending the powder in a surfactant, to form a nanofiller precursor;
- g) admixing the nanofiller precursor into a medium precursor solution; and
- h) curing the medium precursor solution to form a nanocomposite comprising a nanofiller.

14. (Withdrawn) The process of claim 13, wherein the carbon nanotube is selected from the group consisting of multi-walled carbon nanotubes, single walled carbon nanotubes, and combinations thereof.

15. (Withdrawn) The process of claim 13, wherein the nanoplatelet comprises a material selected from the group consisting of clay, nanoclay, graphite, inorganic crystal, organic crystal, and combinations thereof.

16. (Withdrawn) The process of claim 13, wherein the nanofiller solution comprises, at least one exfoliated nanoplatelet associated with at least one oxidized nanotube.

17. (Withdrawn) The process of claim 16, wherein admixing the oxidized nanotube solution and the exfoliated nanoplatelet solution comprises admixing at a nanotube-to-nanoplatelet mass ratio of at least 10:1.

18. (Withdrawn) The process of claim 16, wherein the at least one oxidized nanotube is exfoliated by reversible association with at least one exfoliated nanoplatelet.

19. (Withdrawn) The process of claim 13, wherein the precursor solution is selected from the group consisting of epoxies, plastics, polymers, thermosets, thermoplastics, and combinations thereof.

20. (Withdrawn) An method of making a carbon nanotube nanocomposite, comprising:

a) adding at least one nanotube to a first solution, wherein the first solution oxidizes the at least one nanotube;

b) isolating the at least one nanotube from the first solution and resuspending the at least one nanotube in an aqueous solvent to form an oxidized nanotube solution;

c) adding at least one nanoplatelet to a second solution, wherein the second solution exfoliates the at least one nanoplatelet;

d) isolating the nanoplatelet from the base solution and re-suspending the at least one nanotube in the solvent to form an exfoliated nanoplatelet solution;

e) admixing the oxidized nanotube solution and exfoliated nanoplatelet solution to form a nanofiller solution comprising at least one exfoliated nanotube associated with the at least one nanoplatelet;

f) admixing at least one solvent to the nanofiller solution, to form an agglomerated nanotube-nanoplatelet solution;

g) removing the at least one nanotube from the agglomerated nanotube-nanoplatelet solution;

h) resuspending the at least one nanotube to form an isolated nanotube dispersion;
and

i) admixing the isolated nanotube dispersion in a matrix precursor solution to form a carbon nanotube nanocomposite.

21. (Withdrawn) The method of claim 20, wherein admixing at least one solvent to the nanofiller solution comprises admixing a polar solvent.
22. (Withdrawn) The method of claim 20 wherein the solvent is selected from the group consisting of organic polar solvents, tetrahydrofuran, acetone, alcohol, and combinations thereof.
23. (Withdrawn) The method of claim 22, wherein the solvent comprises a polar aprotic solvent.
24. (Withdrawn) The method of claim 20, wherein admixing at least one solvent nanotube further comprises stabilizing the nanotubes.
25. (Withdrawn) The method of claim 20, wherein removing the at least one nanotube from the agglomerated nanotube-nanoplatelet solution is selected from the group consisting of centrifuging the nanotube-nanoplatelet solution, altering salt concentration, altering the pH, and combinations thereof.
26. (Withdrawn) The method of claim 20, wherein resuspending the at least one nanotube comprises:
- washing the at least one nanotube; and
 - resuspending the at least one nanotube in a surfactant.
27. (Withdrawn) The method of claim 20, wherein the at least one carbon nanotube is selected from the group consisting of multi-walled carbon nanotubes, single walled carbon nanotubes, and combinations thereof.
28. (Withdrawn) The method of claim 20, wherein admixing the isolated nanotube dispersion in a matrix precursor solution comprises admixing the isolated nanotube dispersion in a precursor solution selected from the group consisting of epoxies, plastics, polymers, conjugated polymers, thermosets, thermoplastics, and combinations thereof.

29. (Withdrawn) The method of claim 20, wherein admixing the isolated nanotube dispersion in a matrix precursor solution further comprises curing the precursor solution.

30-31. (Cancelled).

REMARKS

Applicants acknowledge receipt of the non-final Office Action dated May 30, 2012. Claims 1-31 are pending in this case. In the Office Action, the Examiner:

- I.** rejected claims 1 and 9-12 under 35 U.S.C. §102(b) believing them to be anticipated Yrushalmi-Rozen (WO 2005/0783305);
- II.** rejected claims 1, 2, and 9-12 under 35 U.S.C. §102(b) believing them to be anticipated by Koning (US Pat. App. Pub. No. 2006/0211807);
- III.** rejected claims 1-12, 30, and 31 under 35 U.S.C. §102(b) believing them to be anticipated by Blau (W) 2007/119231);
- IV.** rejected claims 1-12, 30, and 31 under 35 U.S.C. §102(e) believing them to be anticipated by Sue (US Pat. App. Pub. No. 2009/0035469);
- V.** provisionally rejected claims 1-3, 9, and 10 believing them to be non-statutory, obvious-type double patenting in view of Sue (US Pat. App. Pub. No. 2009/0035469); and claims 1 and 3 as believing them to be non-statutory, obvious-type double patenting in view of Sue (US Pat. App. Pub. No. 2012/0095143).

Applicant respectfully requests the Examiner to reconsider and withdraw the aforementioned rejections in view of the amendments and the remarks discussed below.

Status of the claims

Claims 1-31 are pending.

Claims 13-39 are withdrawn.

By this response, claims 1, 2, 4, and 5 are amended.

By this response, claims 3, 9-12, and 30-31 are cancelled.

I. Claims 1 and 9-12

The Office Action rejected claims 1 and 9-12 under 35 U.S.C. §102(b) believing them to be anticipated Yrushalmi-Rozen (hereinafter “Y-R”). Claim 1 is an independent claim from which claims 2-8 depend, and claim 9 is an independent claim from which claims 10-12 depend. By this response, claims 9-12 are cancelled, and thus, the rejections of these claims is now moot.

According to MPEP §2131, “a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.”

Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Further, “the identical invention must be shown in as complete detail as is contained in the ...claim,” and “[e]very element of the claimed invention must be literally present, arranged as in the claim” Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

By this response, Applicants amend claim 1 to recite, in part, “a nanofiller, consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium.” No new matter is introduced by these amendments and each is supported by the application as originally filed. For example, these amendments to claim 1 are supported by [0043] of the application as originally filed. To ensure consistency, dependent claim 3 has been cancelled.

Applicants respectfully submit Y-R fails to teach or disclose “a nanofiller consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium” as required by amended claim 1. In particular, Y-R discloses partially untangled, small aggregates, and individual nanotubes in dispersed in block copolymers (pg 7, ln 18-21; ln 25-28).

For at least the reasons given above, Applicants respectfully submit that independent claim 1, as amended, is allowable under 35 U.S.C. § 102(b) over Y-R. Accordingly, Applicants respectfully request withdrawal of this rejection.

II. Claims 1, 2, and 9-12

The Office Action rejected claims 1, 2, and 9-12 under 35 U.S.C. §102(b) believing them to be anticipated by Koning. Claim 1 is an independent claim from which claims 2-8 depend, and claim 9 is an independent claim from which claims 10-12 depend. By this response, claims 9-12 are cancelled, and thus, the rejections of these claims is now moot.

As previously described, amended claim 1 requires “a nanofiller, consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium.”

Applicants respectfully submit Koning fails to teach or disclose “a nanofiller consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated

nanoplatelet disposed within the medium” as required by amended claim 1. In particular, Koning discloses partially exfoliated and individual nanotubes in dispersed in water soluble polymers with electrolytes (See *e.g.* [0015]-[0018]).

For at least the reasons given above, Applicants respectfully submit that independent claim 1, as amended, is allowable under 35 U.S.C. § 102(b) over Koning. Dependent claim 2 must *a fortiori* also be allowable over Koning. Accordingly, Applicants respectfully request withdrawal of these rejections.

III. Claims 1-12, 30, and 31

The Office Action rejected claims 1-12, 30, and 31 under 35 U.S.C. §102(b) believing them to be anticipated by Blau. Claim 1 is an independent claim from which claims 2-8 depend, claim 9 is an independent claim from which claims 10-12 depend, and claim 30 is an independent claim from which claim 31 depends. By this response, claims 9-12, 30, and 31 are cancelled, and thus, the rejections of these claims is now moot.

As previously described, amended claim 1 requires “a nanofiller, consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium.” Applicants respectfully submit Blau fails to teach or disclose “a nanofiller consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium” as required by amended claim 1. In particular, Blau discloses modified nanoclays that are swollen by exposure to solvents (*e.g.* acetone), but fails to disclose the exfoliation of the nanoplatelets (pg 12, ln 21; pg 15, ln 15).

Additionally, the Office states that Fig 4 illustrates that Blau discloses exfoliated nanotubes. However, the disclosure of Blau states that the process was found to “aid the partial opening of nanotube bundles before compounding. However, during claim modification process with carbon nanotube the presence of solvents and surfactants was found to encourage the partial opening of nanotubes bundles.” (see pg 10, ln 9-12)

Further, Example 3 discloses “the distribution of the nanotubes and the opened nanotube bundles throughout the clay.” However, absent specific disclosure or definition of term “open(ed)” in the description of Blau, a skilled artisan would have to attempt to interpret the electron micrographs of Figure 4. Applicant notes that the Figure 4 fails to illustrate monodispersed nanotubes per the

Applicant's definition of "exfoliated." The Applicant notes here that according to MPEP § 2111, the claims must be given their broadest reasonable interpretation consistent with the specification. The Federal Circuit elaborated on this standard by requiring that the broadest reasonable interpretation must be "in light of the specification" as it would be interpreted by one of ordinary skill in the art" per *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004) (emphasis added).

For at least the reasons given above, Applicants respectfully submit that independent claim 1, as amended, is allowable under 35 U.S.C. § 102(b) over Blau. Dependent claims 2 and 4-8 must *a fortiori* also be allowable over Blau. Accordingly, Applicants respectfully request withdrawal of these rejections.

IV. Claims 1-12, 30, and 31

The Office rejected claims 1-12, 30, and 31 under 35 U.S.C. §102(e) as believing them to be anticipated by Sue. Claim 1 is an independent claim from which claims 2-8 depend, claim 9 is an independent claim from which claims 10-12 depend, and claim 30 is an independent claim from which claim 31 depends. By this response, claims 9-12, 30, and 31 are cancelled, and thus, the rejections of these claims is now moot.

As previously described, amended claim 1 requires "a nanofiller, consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium." Applicants respectfully submit Sue fails to teach or disclose "a nanofiller consisting essentially of at least one exfoliated nanotube chemically associated with at least one exfoliated nanoplatelet disposed within the medium" as required by amended claim 1. In particular, paragraphs [0091]-[0092] of the published copy of Sue disclose transferring isolated, individual nanotubes into other systems of interest such as solvents. Paragraph [0094] discloses dispersing functionalized nanotubes into an epoxy (*e.g.* treated with sulfanilamide). However, these passages fail to disclose the limitations of instant amended claim 1 pertaining to a nanofiller consisting of nanotubes and nanoplatelets.

For at least the reasons given above, Applicants respectfully submit that independent claim 1, as amended, is allowable under 35 U.S.C. § 102(b) over Sue. Dependent claims 2 and 4-8

must *a fortiori* also be allowable over Sue. Accordingly, Applicants respectfully request withdrawal of these rejections.

V. Double Patenting

The Office provisionally rejected claims 1-3, 9, and 10 under 35 U.S.C. §102(e) as believing them to be non-statutory, obvious-type double patenting in view of Sue (US Pat. App. Pub. No. 2009/0035469); and claims 1 and 3 as believing them to be non-statutory, obvious-type double patenting in view of Sue (US Pat. App. Pub. No. 2012/0095143). Applicants respectfully request the Examiner hold the double patenting rejections in abeyance. Applicants' request is made as the double patenting rejections and requirements for terminal disclaimers may be obviated by claim amendments that are made in the instant claims or the claims of the allegedly conflicting application during prosecution.

CONCLUSION

Applicants respectfully request reconsideration and that a timely Notice of Allowance be issued in this case. No new matter is introduced by way of amendment. It is believed that each ground of objection and rejection raised in the non-final Office Action dated May 30, 2012 has been fully addressed. If any item has been overlooked, Applicants respectfully request the opportunity to supplement this response. If the Examiner feels that a telephone conference would expedite the resolution of this case, the Examiner is respectfully requested to contact the undersigned.

In the course of the foregoing discussions, Applicants may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. Moreover, it should be understood that there may be other distinctions between the claims and the prior art that have yet to be raised, but which may be raised in the future.

It is believed that no extensions of time or fees are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required (including fees for net addition of claims) are hereby authorized to be charged to Conley Rose, P.C.'s Deposit Account Number 03-2769.

Respectfully submitted,

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