Current Trends in Nanotech Patents: A View From Inside the Patent Office

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ABSTRACT

Patents are critical to commercialization of nanotechnology. With large numbers of patents being filed, investors, lawyers, and managers must understand legal issues involving nanotech patents and carefully monitor patent issuances, licenses, and litigation. In this article, PTO examiner Vivek Koppikar and patent attorneys Stephen Maebius and Steve Rutt discuss trends in nanotechnology patents. They first survey the patent landscape and demonstrate that large numbers of nanotech patents are being filed in different areas of nanotechnology. They then discuss what the PTO is doing to prepare for the continued increase in applications. Finally, they analyze obstacles that applicants might face in filing nanotech patents. Specifically, the doctrines of inherent anticipation, obviousness, and enablement might be used by examiners to reject or require amendment of claims.

INTRODUCTION

Many areas of nanotechnology have witnessed a sharp increase in the number of patents filed. At the same time, the U.S. patent law has undergone tremendous change. The confluence of these events presents both challenges and opportunities for the investment world as more nanotechnology start-up companies are going through the initial rounds of funding in the face of a rising tide of patents, many of which are now focused on end products and applications, not just methods of making. Moreover, the examining corps of the U.S. Patent Office, who must examine this rising tide of nanotechnology applications in the face of limited resources (due to Congressional siphoning of Patent Office funds for unrelated expenditures), faces a great challenge to promptly issue patents in this area, while at the same time carefully and meticulously examining each one to prevent unwarranted overreaching. Lastly, patent practitioners, who may not have much experience dealing with cross-disciplinary technology, face a great challenge in properly drafting patent claims to reach the many and diverse applications often associated with a single nanotechnology invention and in addressing rejections they may not be used to encountering.

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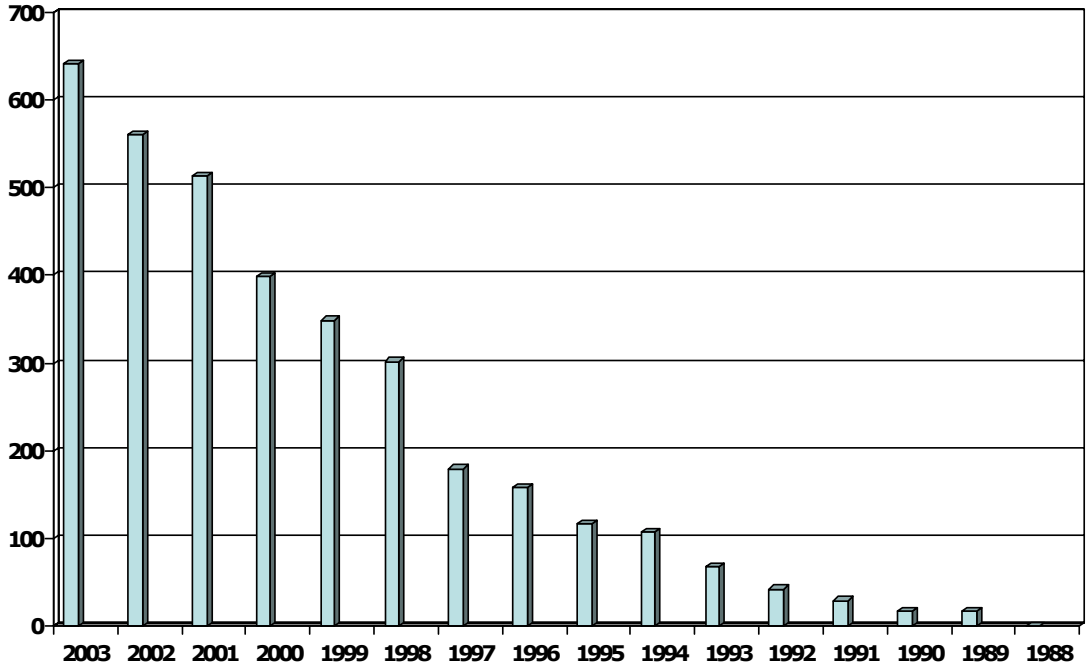
I. NANOTECHNOLOGY PATENT TRENDS

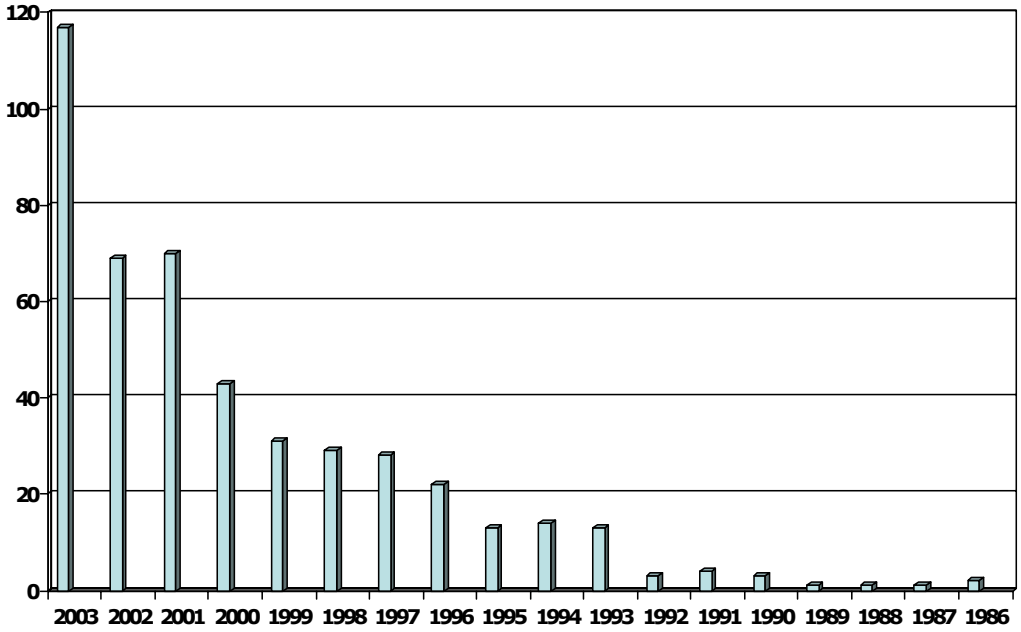
Patents issuing every week demonstrate the growing importance of nanotechnology. In many cases, technology which was first conceived in the 1970s and early 1980s, often as academic curiosities, have now become a major area of commercial development under the nanotechnology rubric. Several examples are noted below reflecting different areas of nanotechnology. The atomic force microscope (AFM) is a powerful, fundamental nanotechnology tool and was first patented in 1988 by Bennig and IBM. By 1994, over 100 patents issued per year, and by 2003, over 500 patents were issuing per year referring to this tool (*Figure 1*). Quantum dots and dendrimers, similarly, are examples of nanomaterials first patented in the mid-1980s. By 1994, over ten patents issued per year, and by 2003, over 100 patents were issuing per year referring to each of these materials (*Figures 2* and *3*).

Figure 1
Number of US Patents Referring to "AFM" or "Atomic Force Microscope"



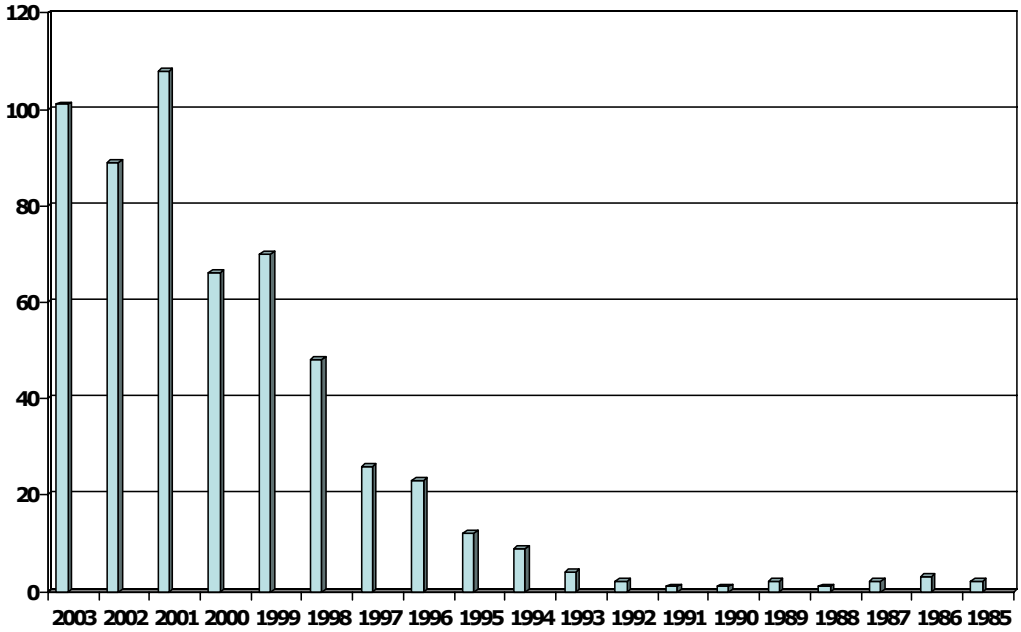
* For patents issued through September 16, 2003, extrapolated to end of 2003.
** Note that minor non-nanotechnology uses for "AFM" were found which do not impact the general nanotechnology patent trend discussed herein.

Figure 2
Number of Patents Referring to "Quantum Dot"



* For patent issued through September 16, 2003, extrapolated to end of 2003.

Figure 3
Number of Patents Referring to "Dendrimer"



* For patents issued through September 16, 2003, extrapolated to end of 2003.

As shown in the figures, in many different areas of nanotechnology, the intellectual property landscapes are fragmented. A large number of patents held by different entities cover similar inventions and improvements to the same invention. As products come to market, there are certain to be a number of disputes. The chaotic and uncertain environment presents a number of strategic challenges for nanotech companies. A company must have a thorough understanding of the patent landscape, develop concrete IP strategies, and constantly monitor patent publications, issuances, licenses, and litigation.

II. THE PTO AND NANOTECHNOLOGY PATENTS

On September 11, 2003, the Patent Office held its first Nanotechnology Customer Partnership Meeting to address issues raised by the public about nanotechnology patents, a sign that the Patent Office leaders are beginning to recognize the importance of nanotechnology. Prior to this event, the Patent Office had taken other initiatives to improve the handling of nanotechnology applications, such as bringing in nanotechnology scientists to educate the examining corps about recent developments to develop a better understanding of the technology.

The meeting revealed, however, that the Patent Office has no immediate plans to create a nanotechnology examining group. No one can deny that it would be difficult to create a separate examining group at this point in time because of the sheer breadth of technological areas encompassed by the active areas of nanotechnology research and the still-developing nomenclature that distinguishes nanotechnology from other areas which have acquired their own examining groups (such as biotechnology).

The situation resembles the early stages of the biotechnology examining group, when new applications being filed on DNA technology were initially handled by the chemical group. As time passed, larger numbers of applications were filed and more nomenclature developed to differentiate distinct areas (DNA, peptides, proteins, antibodies, assays). Eventually, the leadership of the Patent Office chose to split out biotechnology into a distinct group.

A necessary predicate to developing a nanotechnology examining group is the development of a classification system for nanotechnology so that the Patent Office can track the number, pendency and assignment of nanotechnology patent applications. But the Nanotechnology Customer Partnership Meeting revealed that there is presently no classification system being prepared for nanotechnology applications. At present, there is a classification for fullerene-related patent applications, but no separate classes for areas such as nanotubes or nanowires. Therefore, the Patent Office cannot presently provide statistics about the number of nanotechnology applications pending or how long they are taking on average to be examined, nor can the Patent Office ensure uniform handling of the applications, for example, by directing new applications with nanowire claims to the same examiner or group of examiners with experience in that area. The Patent Office is taking steps to identify, on a case-by-case basis, areas where a new class or subclass should be created, so there is hope that such a classification system will be developed in time.

III. NANOTECHNOLOGY PATENT ISSUES

There are some relatively unique situations faced by applicants who file nanotechnology patents. PTO examiners might object to claims based on the doctrines of inherent anticipation, obviousness, and enablement. It is important to note that, even if applicants can successfully patent their inventions, they could confront later challenges to their patents based on these doctrines in litigation, which is why it is so important to have many claims of varying scope that create fall-back positions in future litigation.

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1. Size-Based Patentability as Impacted by Anticipation, Inherency and Obviousness

First, applicants attempting to patent the nanoscale form of a material or device that already exists at the micro scale could face rejections under § 102 or § 103. Section 102 bars patenting inventions that have been anticipated by prior art.[1] However, if there is at least one clear difference in the physical properties between two products, such as a product that has a fluid-conducting channel that is one micrometer in width and a product that has a fluid-conducting channel that is one nanometer in width, there cannot be anticipation.

Another potential complication for nanotech applicants is the doctrine of inherency. Under the doctrine of inherency, a prior art reference may "inherently" anticipate a claimed invention, even if the reference does not expressly disclose the later invention.[2] Referring to the prior example, suppose the prior art reference did not clearly indicate the exact physical size of the fluid-conducting channel. In this situation, a patent examiner may argue that the nature of the fabrication method used to form that conducting channel "inherently" would have produced a channel of a single nanometer in width. The case law in this area holds that inherency can only be applied if the alleged feature would necessarily and inherently result – a result that might have occurred under certain conditions is not good enough to deny patentability.

Yet another potential complication is obviousness under § 103.[3] Even if there is a clear difference in size, the examiner may argue that the difference is obvious. Section 103 requires inventions to not be obvious in order to be patentable. An invention is obvious if the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success.[4]

The foregoing discussion illustrates that a common question faced by nanotechnology patent applicants is whether a smaller version of an existing product is patentable based on size alone. One of the Patent Office officials who presented at the recent Nanotech Customer Meeting suggested that the answer might be "no." In a PowerPoint presentation, this official cited *In re Rose*,[5] where claims directed to a lumber package "of appreciable size and weight requiring handling by a lift truck" were held unpatentable over prior art lumber packages which could be lifted by hand because "the elements and features perform in combination the same function as set forth in said prior art without giving an unobvious and unexpected result."

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1 35 U.S.C. § 102 (2003).

2 *See* Verdegaal Bros., Inc. v. Union Oil Co., 814 F.2d 628, 631, 2 U.S.P.Q.2d (BNA) 1051, 1053 (Fed Cir. 1987) ("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.").

3 35 U.S.C. § 103 (2003).

4 *In re* Dow Chemical Co., 837 F.2d 469, 473 (Fed. Cir. 1988) ("The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art."). Although the obviousness determination is a legal conclusion, the court must make factual inquiries including: the scope and content of prior art; differences between the prior art and the claims at issue; and the level of ordinary skill in the art. Graham v. John Deere Co., 383 U.S. 1, 17 (1966). Courts have repeatedly emphasized that "obvious to try" is not the standard and that the use of "hindsight" is prohibited in making obviousness determinations. *See, e.g., In re* O'Farrell, 853 F.2d 894, 903 (Fed. Cir. 1988).

5 220 F.2d 459, 464, 105 USPQ 237 (CCPA 1955). *See also In re* Rinehart, 531 F.2d 1048, 1053, 198 USPQ 143 (CCPA 1976) ("Mere scaling up of a prior art process capable of being scaled up, if such were the case, would not establish patentability in a claim to an old process so scaled."); *and In re* Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), *cert. denied*, 469 U.S. 830, 225 USPQ 232 (1984) (holding that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device).

In the context of this case, it is not surprising that a court would find it obvious to change the size. One must bear in mind that this case was based on simple mechanical technology of the past, where it would have indeed been obvious to cut parts to larger or smaller dimensions in order to make the overall package larger or smaller.

However, the more accurate answer for nanotechnology patent applications in this situation is, "it depends." If the prior art does not *enable* one to make a smaller version of an existing device *at the nanoscale*, then the resulting nanoscale version of the same device may in fact be non-obvious over its larger cousin even if there is no difference other than size. This important point of law was established first in the chemical area, in the case of *In re Hoeksema*,[6] where an examiner rejected a claimed chemical compound on the ground that its structure was already suggested by the prior art. On appeal, the court reversed the examiner's rejection, holding that a claimed chemical compound could be unobvious, even though its structure is suggested, when no process existed at the time that would have enabled its production. That is, a prior art reference must provide an enabling disclosure of how to make the compound before the claimed compound can be found obvious. Likewise, a nanotechnology product could be found unobvious on the basis of size alone if the prior art references in existence before the application was filed fail to provide an enabling method of making it at the nanoscale.

Indeed, this points out the challenge for all participants who are involved in the process of patenting nanotechnology. Case law from diverse disciplines may apply to an invention in nanotechnology. A given patent examiner from the mechanical group may not be aware of cases such as *In re Hoeksema*, which arose out of the chemical arts. An alert patent attorney can spot issues such as this and bring the patent application to a successful conclusion with the right cases to educate the examiner. Moreover, one must recognize in the first instance that a smaller version of an existing device can be patentable, or else the patent application might never even be filed.

2. Enablement

Second, applicants drafting broad claims might face rejections based on the enablement doctrine.[7] The enablement doctrine requires the inventor to provide sufficient information to enable a person skilled in the relevant art to make and use the claimed invention without "undue experimentation."[8] In biotechnology, examiners and courts have used the enablement doctrine to narrow the scope of overly broad claims.[9] A typical rejection states that the scope of the claim is too broad in relation to the number of examples provided in the specification, given the level of unpredictability that existed in the area of the invention at the time the application was filed.

In reviewing the first wave of nanotechnology patents, the PTO has shown that it will issue claims of considerable breadth in some instances (a detailed analysis of the factors that determine claim scope is beyond the scope of this paper) despite the enablement requirement. For example, the Patent Office has issued patents with claims that appear broad on their face relating to carbon-based tubes and microelectronic devices which utilize carbon-containing materials.

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[6] 158 USPQ 596 (CCPA 1968).

[7] 35 U.S.C. § 112 (2003).

[8] Genentech, Inc. v. Novo Nordisk A/S, 108 F.3d 1361, 1365, 42 U.S.P.Q.2D (BNA) 1001, 1004 (Fed. Cir. 1997).

[9] *See, e.g., In re* Goodman, 11 F.3d 1046, 1052-53 (Fed. Cir. 1993) (holding that a single example could not "enable a biotechnician of ordinary skill to produce any type of mammalian protein in any type of plant cell."); *and* Enzo Biochem, Inc. v. Calgene, 188 F.3d 1362, 1372 (Fed. Cir. 1999) (holding that claims directed to genetic antisense technology in the "entire universe of cells" were not enabled, because the disclosure only discussed *E. coli* cells).

One important way for nanotech applicants to overcome an enablement rejection is to argue that the specification does provide a "representative" group of examples in relation to the scope of the claim based on the relative predictability of the area in question. An applicant in the U.S. is even permitted to submit post-filing date test results which confirm the statements made in the specification as filed.[10]

As time passes, the PTO can be expected to more carefully scrutinize claims in nanotech patents, a cycle that occurred in the biotech industry. The first wave of biotechnology patents issued by the PTO contained extremely broad claims. As the field matured, and many of the broad biotech patents were litigated and found invalid, then examiners began to require applicants to narrow the scope of the claims. Similarly, as the agency becomes more familiar with nanoscience and the prior art, it will be more likely to flag an overly broad claim and reject it or force the applicant to make an amendment.

IV. CONCLUSIONS

The increasing numbers of issued patents in this field means that those seeking to commercialize products must look out for the patents of others. In addition, patents in this area may be broad in scope if there is no known previous work that would give the Patent Office a basis for limiting the scope of the claims and enablement issues are successfully overcome. Nanotechnology brings together many disciplines of science. Therefore, filing a patent application relating to an invention in nanotechnology requires careful consideration of the potential end uses so that they are adequately covered by the patent, an exercise which may draw upon expertise in several different fields. For example, an invention in quantum dots may have applications in both semiconductors and tagging of biological materials. Unique legal issues will arise, such as the question of whether a smaller device can be patented when its only difference is size, that require an understanding of case law from diverse areas. Practitioners who understand both the technology and the law will be able to expedite the patent process by educating examiners from diverse disciplines.

[10] See the U.S. PTO training guidelines for § 112 rejections in chemical and biotechnology inventions, which states as follows (emphasis supplied):

> To overcome a *prima facie* case of lack of enablement, applicant must demonstrate by argument and/or evidence that the disclosure, *as filed*, would have enabled the claimed invention for one skilled in the art at the time of filing. *This does not preclude applicant from providing a declaration after the filing date which demonstrates that the claimed invention works.* However, the examiner should carefully compare the steps, materials, and conditions used in the experiments of the declaration with those disclosed in the application to make sure that they are commensurate in scope, i.e., that the experiments used the guidance in the specification as filed and what was well known to one of skill in the art. Such a showing also must be commensurate with the scope of the claimed invention, i.e., must bear a reasonable correlation.