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Navigating Nanotechnology Patents: Need for Global Attention

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Abstract: *Nanotechnology, the control and manipulation of matter at the nanoscale, is revolutionizing industries such as medicine, electronics, and energy. However, it presents unique challenges to the existing intellectual property rights (IPR) frameworks globally, particularly within patent law.This paper discusses some specific examples of the complexity that surfaces in the patenting of nanotechnology on issues such as novelty, overclaiming, and very broad patent claims. These problems are compounded by the applications spanning across multiple industries of nanotechnology and the problems of complete searches of prior arts. Other problems of enforcement presented by nanotechnology patents, particularly selection inventions, arise due to cross-industry applications and the high cost of detection. The challenges for obtaining nanotechnology patents are further heightened by the constraints of Section 3(d) of the Indian Patent Act, which imposes limitations on the patentability of derivative inventions. In this paper, the patenting of nanotechnology issues are examined in the context of IPR and reforms are proposed to strengthen the patent regime to support innovation and address unique needs in nanotechnology.*

Keywords: Nanotechnology, Novelty, Patenting, Patent thickets and Prior Art.

I. INTRODUCTION

Nanotechnology is the control and manipulation of matter at the atomic and sub-molecular level affecting all from the pharmaceutical companies to electronics, all of which have continued pushing to new frontiers in innovation. It brings about an important necessity for IP protection related to nanotechnology advancements. Patenting nanotechnology as an Intellectual Property Right is likely to be a rather controversial legal issue, as the peculiar properties of nanoscale inventions create difficulties in the existing IP laws. The principles of patent law, which have been traditionally designed to encourage innovation through exclusive rights to the inventors, are currently being tested by the complexities introduced by nanotechnology. A relevant issue in the subject of nanotechnology patents is deciding to what extent standard patent eligibility criteria, that is, inventive step, novelty and industrial applicability apply to nanoscale inventions[1]. Principle of novelty in nanotechnology is often present in changes made to materials or constructions that are well-known before and may obscure an actual inventive step with minor steps over prior art[2].Moreover, nanotechnology applications cover broad domains from medicine to electronic devices to material science, the classification and interpretation of such patent applications are indeed more complex[3].The other challenge within the patentability landscape of nanotechnology includes the rise of patent thickets, which characterize numerous relative patents with different dimensions of a single product or process. Fragmentation can hinder further innovation as it creates legal and financial barriers for entrants in that industry[4]. Moreover, a patentability issue related to naturally occurring nanoscale materials and phenomena, such as carbon nanotubes, is an issue under legal interpretation requiring courts to distinguish the kind of discovery from a patentable invention[5].This paper tries to present a complete analysis

[1]Raj B. Bawa, Patents and Nanomedicine, 2 *Nanomedicine: Nanotechnology, Biology and Medicine* 351 (2007).
[2]Mark A. Lemley, *Patenting Nanotechnology,* 58 *Stan. L. Rev.* 601 (2005).
[3]Angela Hullmann, *Nanotechnology: Trends and Challenge*s in Patent Applications, *Nat. Nanotechnol.*, Apr. 2006, at 23.
[4]Geertrui van Overwalle, *Patent Thickets in Nanotechnology: A Global Challenge,* 7 *Nat. Nanotechnol.* 312 (2012).
[5]Arti K. Rai*, Nanotechnology and the Patent System*, 56 *Duke L.J.* 1933 (2007).

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of the current landscape of nanotechnology patenting within the IPR regime. It evaluates key challenges that the current patent law struggles with rapidly emerging field and also analyses significant case laws and goes on to evaluate possible reforms to ensure that nanotechnology patents find a balance between protecting innovation and facilitating further research and development.

Understanding Nanotechnology: The Science of the Tiny

The International Organization for Standardization defines nanotechnology as "understanding and control of matter and processes at the nanoscale, typically, but not exclusively, below 100 nanometres in one or more dimensions, where size-dependent phenomena enable novel applications".[6]At the nanoscale, materials often exhibit unique properties, such as enhanced strength, greater chemical reactivity, or improved electrical conductivity, which are not observed to the same extent in the macroscopic world. The capacity to control matter at such a microscopic scale has unveiled new possibilities in disciplines including medicine, electronics, and materials science[7].Nanotechnology is inherently multidisciplinary, combining concepts from physics, chemistry, biology, and engineering. It has immense potential to transform sectors by changing the performance and functionality of products -- like nanoparticles used in cell-targeting drug-delivery systems or nanomaterials used for enhancing electronic device performance[8]. On the other hand, these diverse applications of nanotechnology present intricate challenges for the intellectual property framework -- especially when it comes to patenting.Since novelties in nanotechnology usually overlap with several disciplines and involved sophisticated methodologies, meeting some of the prerequisites for patent law –inventive step, novelty, and industrial applicability - can be challenging. Differences in dimensions or configurations of small sizes may feature remarkably different properties, and therefore, complicated the process of the patent examination.[9] Another problem that could arise from this is the lack of standard terminology in nanotechnology, which can result in problems classifying and identifying patents under such technology, sometimes yielding broad claims and overlapping rights.[10]This calls for adequate adaptation in patent systems all over the world to meet challenges that nanotechnology specifically brings and to respond thereto. In addition to this, there is a need for the patent examiner and/or administrator to be adequately equipped technically so that innovations in nanotechnology can be appraised properly, and at the same time, encourage innovation and protect the rights of an inventor.

Protection of Nanotechnology Under Intellectual Property

Innovations under nanotechnology encompass a variety of intellectual properties that primarily fall under patents. Such key protectable IP includes: Nanomaterials- Such NPs or compositions of matter as nanoparticles, nanotubes, and nanowires reveal some unique properties when manipulated at the nanoscale.[11]Processes - Methods of producing or handling nanomaterials; these include methods of manufacture and computational processes.[12]Apparatus and Equipment - Devices and instruments that are used to generate, process or characterize nanomaterials, including

[6] International Organization for Standardization (ISO), *"Nanotechnologies—Vocabulary*," ISO/TS 80004-1:2015

[7]Angela Hullmann, *The Economic Development of Nanotechnology—An Indicator Based Analysis,European Commission* (2006).

[8]Sanjeeb K. Sahoo & Vinod Labhasetwar, *Nanotech Approaches to Drug Delivery and Imaging, Drug Discovery Today,* Nov. 2003, at 965.

[9]Mark A. Lemley, *Patenting Nanotechnology*, 58 *Stan. L. Rev.* 601 (2005).

[10]Indrani Barpujari, *The Patent Regime and Nanotechnology: Issues and Challenges,* 15 *J. Intell. Prop. Rts.* 206 (2010).

[11] Indrani Barpujari, *The Patent Regime and Nanotechnology: Issues and Challenges*, 15 *J. Intell. Prop. Rts.* 206, 208 (2010).

[12] Behfar Bastani & Dennis Fernandez, *Intellectual Property Rights in Nanotechnology,Int. Tech. L.*, 472, 473 (2002).

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diagnostic devices whose technology involves nanoscale structures.[13]Application-End-use applications of nanotechnology, such as in drug delivery systems, electronics and environmental monitoring.[14]

While patents are the strongest type of protection, proprietary manufacturing techniques can also be maintained as trade secrets; trademarks can protect any brand identity related to nanotechnology products. There are issues to determine the novelty under nanotechnology. Novelty-the other fundamental requirement for patentability defines that the new thing invented must never have been known or made public in the "prior art"[15]. The nanotechnology area poses difficulties to this standard when many inventions make use of materials already available but on a nanoscale. The latter can exhibit properties that are fundamentally different from those at the macro scale, which brings up the issue of whether size reduction is sufficient to establish novelty.For example, carbon nanotubes or nanoparticles could behave entirely in conflict to that seen at the macro scale in other materials, such as electronic or chemical differences[16]. Patent office's then have to weigh those differences alone enough to grant novelty over the invented material or if the material was known for ages in another form. In addition to the above, there are complex issue on identifying he size and new properties. Whether for decisions of the judiciary only the reduction of dimension is enough for proven novelty was judged. What is relevant here is the most important case *BASF v. Orica Australia* where it has been held by the European Patent office (referred to as EPO) that particles smaller than 100 nanometres possess substantially better properties than the same particles which are only slightly larger than 100 nanometres. The EPO, however, held that this invention satisfies the novelty requirement since small particles were made from a known but possessing properties not predictable and new substance.[17]Further, the example can be found in *SmithKline Beecham Biologicals v. Wyeth Holdings Corporation* where the EPO ruled that the vaccine adjuvant novelly eligible even when the prior patent disclosed an adjuvant with particles of about 80-500 nanometres in size and particles between 60 and 120 nanometres. The judiciary concluded that the particle size of the new discovery being of very small nature comprises unique and desirable properties, which made it a legitimate innovation[18]. These examples show that if slightly diminished dimensions in nanotechnology produce new inventions, then they become valid innovations given that they possess novel and advantageous attributes.

Challenges of Overclaiming and Broad Claims in Nanotechnology Patents

Applicant overclaiming is one of the major problems in nanotechnology patents. The situation herein is described as overclaiming because of its raw breadth and interdisciplinary nature of any innovation within the domain of nanotechnology. Patentees may derive claims for the utmost extent of protection that may prove too vague; hence, it may extend and include all of the subsequent applications that the inventor had never directly created or envisaged.[19] This overclaiming creates a number of problems, but topmost in this is patent thickets, whereby several patents with overlapping claims cover different aspects of the same technology.[20]This may deter innovation by making researchers and developers wade through a morass of patents as they seek to secure several licences to avoid infringing those

[13] Sean O'Neill et al., *Broad Claiming in Nanotechnology Patents: Is Litigation Inevitable?*4 *Nanotech L. & Bus.* 29, 30 (2007).

[14] Sahoo, Sanjeeb K. & Vinod Labhasetwar, *Nanotech Approaches to Drug Delivery and Imaging,Drug Discovery Today*, Nov. 2003, at 965.

[15]*Agreement on Trade-Related Aspects of Intellectual Property Rights,* Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 (1995).

[16]Angela Hullmann, *Nanotechnology: Trends and Challenges in Patent Applications*, *Nat. Nanotechnol.*, Apr. 2006, at 23.

[17] *BASF v. Orica Australia*, T-0547/99 (EPO, 2000).

[18]*Smithkline Beecham Biologicals v. Wyeth Holdings Corporation*, T 0552/00 (EPO, 2004).

[19] Mark A. Lemley, *Patenting Nanotechnology,* 58 *Stan. L. Rev.* 601, 608 (2005).

[20] Geertrui van Overwalle, *Patent Thickets in Nanotechnology: A Global Challenge,* 7 *Nat. Nanotechnol.* 312, 314 (2012).

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patents.[21]It's just that sorts of premature sweeping claims which would now impede possible downstream innovations, fields like drug delivery or electronics, where a large number of different entities must offer a similar fundamentally based nanomaterial.[22] This has seen concerns over the potential for litigation and trouble in enforcing such sweeping claims has begun the current debate over whether or when nanotechnology processes and materials should ever be patented. Many practitioners recommend patent office's make requirement of stringent examination, and focus more on claim clarity and scope rather than overclaiming.[23] In the Court also can use the reverse doctrine of equivalents wherein the enforcement of unduly broad claims of a patent is barred when such alleged product or process functions substantially differently while still within literal meaning of the claim.[24] There are ways and means to identify the patent claims. The problem caused by broad patent claims in the nanotechnology field has raised the fear of it representing a barrier to innovation with too much litigation. Many possible solutions can help raise the issues caused by broad patent assertions in this dynamic field. This section identifies major approaches proposed to address these challenges.1. More-stringent standards of patent examination-Patent offices may further enforce the examination criteria for nanotechnology patents specially applied to claim scope. This now requires more precise descriptions of inventions and applications in that claims should notcover more than an inventor has developed or conceived.They can be used for imposition of strict definiteness standards in *Nautilus, Inc. v. Biosig Instruments, Inc*., wherein the Supreme Court underscored that "claims in a patent are clear and definite for another to understand how extensive is the invention"[25] and they should also make sure that assertions are not too vague, yet sufficient in support from the specification.[26]2. Doctrine of Reverse Equivalents on Application- In other words, the reverse doctrine of equivalents could be applied by courts to reduce the scope of broad patent claims. The reverse doctrine of equivalents is also defined as follows: There is no infringement in that so-called infringing product or process, which literally comes within the limits of a patent claim, functions entirely differently than the patented invention. The reverse doctrine of equivalents was based on the case *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, wherein the Court held that literal infringement may be invalid if the device at issue has considerable differences from the patented invention.[27]3. Encouraging Patent Pools and Cross-Licensing Deals-Companies and researchers can create a patent pool or cross-license to avoid patent thickets with wide-ranging claims. A patent pool is just a number of different patent owners teaming together to license their rights collectively, thereby reducing the risk of litigation and providing broader access to fundamental technologies. Patent pools have proven to be effective in many different areas of technologies, including an IP pool of DVD technology.[28] This framework of patent pooling in nanotechnology should create more innovation with fewer legal hurdles'4. Reduction of Patent Claims by Claim Construction- The claim construction tool is used effectively by the judiciary and patent examiners to limit the scope of very broad claims. Focusing on the words that the court deems exact in the patent claims and their accompanying specifications prevents more expansive allocations of meanings than those harboured originally by the inventor in question. In *Phillips v. AWH Corp.,* the Federal Circuit explained that the fact that a specification guides the interpretation of patent

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[21] James Bessen, *Patent Thickets: Strategic Patenting of Complex Technologies,Boston Univ. Sch. of L. Working Paper* No. 0401, 2004.

[22] Sean O'Neill et al*., Broad Claiming in Nanotechnology Patents: Is Litigation Inevitable?* 4 *Nanotech L. & Bus.* 29, 31 (2007).

[23] Indrani Barpujari, *The Patent Regime and Nanotechnology: Issues and Challenges*, 15 *J. Intell. Prop. Rts.* 206, 210 (2010).

[24] M. Veronica Mullally & David R. Winn, *Patenting Nanotechnology: A Unique Challenge to IP Bar,N.Y. L.J.*, May 2004.

[25]*Nautilus, Inc. v. Biosig Instruments*, Inc., 572 U.S. 898 (2014).

[26] Indrani Barpujari, *The Patent Regime and Nanotechnology: Issues and Challenges,* 15 *J. Intell. Prop. Rts.* 206, 211 (2010).

[27]*Graver Tank & Mfg. Co. v. Linde Air Prods. Co*., 339 U.S. 605 (1950).

[28] James Bessen, *Patent Thickets: Strategic Patenting of Complex Technologies*, *Boston Univ. Sch. of L. Working Paper* No. 0401, 2004.

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claims, such that constructions too broad to be within the actual scope of the invention should be avoided.[29]5. Modifying Patent Legislation to Accommodate Emerging Technologies - Nanotechnology may, therefore be one of the fast-emerging fields that require specialized legal amendment considered to address its peculiar challenge. The policymaker might look towards the tougher utility criteria; for example, they could limit patent rights for downstream applications of nanotechnology rather than allowing broad claims on upstream materials or processes. An amendment to the patent law stressing utility and industrial applicability will also prevent speculative patenting practices and encourage more accurate claims toward practical, real-world applications.[30]

Examination of Person Skilled in the Art and Issues of Addressing Prior Art Search

In nanotechnology, it is hard to define person skilled in the art since this field includes various disciplines like chemistry, physics, biology, and material science.[31] Unlike conventional areas of expertise that specialize in one of the scientific disciplines, a Person Skilled in the Art of nanotechnology has knowledge of multiple ones. Such a broad scope of knowledge makes inventive step and scope of prior art assessment more challenging because the PSIA's knowledge should encompass many technologies and scientific principles[32].

In *KSR International Co. v. Teleflex Inc.,* the United States Supreme Court emphasized that an approach to Problem-Solving Invention Approach (PSIA) indeed demands only "ordinary creativity"; however, in nanotechnology, such creativity is highly diversified and falls under a highly wide range of fields[33]. For instance, in the case of *SmithKline Beecham Biologicals v. Wyeth Holdings Corporation*, the European Patent Office (EPO) had to deduce whether the adjuvant vaccine made of nanoparticles formed in it, owing to their inherent property, was novel or not.[34]Interdisciplinarity is the main reason why nanotechnology is complex. The relevant prior arts came from different fields. Hence, it is not easy to get all the references that can be applied. For this, specialized databases and classifications have been established and include that of USPTO's "977" class for nanotechnology patents.[35] In this way, the examiners at their proper expertise handle the nanotechnology applications, which thereby enhances the detection of the prior art.[36]Here are some proposed strategies against those challenges, such as team-oriented patent evaluations. Specialists from different disciplines collaborate to assess inventive steps and existing prior art. Another strategy is to enhance the cooperation of international patent offices and standardize classifications for nanotechnology patents, thus greatly improving the comprehensive search of prior art.[37]

Contemporary Issues of Enforcement of Nanotechnology Patents

Selected inventions-inventions based on particles within overlapping size ranges-fall under the nanotechnology umbrella, and are used in almost every industry, causing severe difficulties in enforcing patents. Due to its extremely high price, it is not feasible to test every product suspected to infringe a nanotechnology patent to see if the product infringes upon a nanotechnology patent. Much of the current application of nanotechnology extends further into universities and research labs, making it a bit complex to detect unauthorized patent use.[38]Although selection inventions

[29] *Phillips v. AWH Corp.,* 415 F.3d 1303 (Fed. Cir. 2005).
[30] Mark A. Lemley,*supra* note 19, at 609.
[31] Indrani Barpujari, *The Patent Regime and Nanotechnology: Issues and Challenges*, 15 *J. Intell. Prop. Rts.* 206, 209 (2010).
[32] Behfar Bastani & Dennis Fernandez, *Intellectual Property Rights in Nanotechnology*, *Inf. Tech. J.*, 472, 474 (2002).
[33] *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007).
[34] *Smithkline Beecham Biologicals v. Wyeth Holdings Corporation*, T 0552/00 (EPO 2004).
[35] Vance McCarthy, USPTO Poised to Ring in a New Era of Simplified Search and Better Visibility for Nano Patents, *Nano Sci. & Tech. Inst.*, May 2005.
[36] Maurice Schellekens, *Patenting Nanotechnology in Europe: Making a Good Start? An Analysis of Issues in Law and Regulation,* 13 *J. World Intell. Prop.* 575, 580 (2010).
[37] Barpujari, *supra* note 1, at 211.
[38] Vance McCarthy, *USPTO Poised to Ring in a New Era of Simplified Search and Better Visibility for Nano Patents*, *Nano Sci. & Tech. Inst.*, 2005.

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are not defined clearly under the statutory law, the judiciary has defined it.[39] In order to avoid the force of patents issued relating to selection inventions, absolute injunction against the grant of a new patent needs to be avoided. Accordingly, patent offices should make sure that nobody got patents based on already existing patents . In the case of *Novartis A.G*, a certain very basic guidelines were set out by the Intellectual Property Appellate Board for testing patentability in selection inventions. This goes on to avoid new patents from infringing on old patents.[40] The established criteria for them are:The specification determines whether the invention is of a choice.

- Whether the selection is from well-characterized class of compounds.
- Whether the substance chosen is novel.
- Determination of whether the selection stems from human involvement and creativity or mere validation.
- Whether the choice is unexpected or probable.
- Whether the chosen substance discovers new and useful properties.[41]

Indian's stand on Patenting of Nanotechnology

India now stands at the threshold of entering the nanotechnology sector that promises to revolutionize health care, electronics, and related businesses. The intellectual property regime of this country, or patent law at least, throws up a host of challenges that may discourage the development and diffusion of nanotechnology. Patent "thickets," the term used to describe numerous patents crossing at one point, or prohibitively high licensing fees, could deter further research and commercial activities. Indian patent law, under the Patents Act of 1970, meets the minimum requirement of the TRIPS Agreement, which specifies that patents should be granted to inventions, if they are new, not obvious and capable of industrial application under art. 27 of TRIPS Agreement, 1995. [42]In India, the parameters to arrive at patentability are novelty, inventive step and utility as enunciated under Section 2(j) of Patents Act, 1970. [43]For better clarification on the inventive step, Section 2(ja) lays down that such an invention should show either a technological advancement or economic significance in comparison with the prior art.[44]This sets a nanotechnology invention a high bar-they must be established to show visible innovation beyond the current state of the art.The application of this criterion, however, with an overly strict attitude-very particularly in the context of nanotechnology-poses an obstacle to incremental innovation that often stretches toward patentability-a feature that is very usual for the discipline. For example, such developments rarely and necessarily reach the inventive step criterion and would normally be rejected by the patent office's considering that manipulation typically occurs at the atomic or molecular scale.Section 3(d) and Problems on Patentability of Nanotechnology as follows: A major obstacle to nanotechnology patenting in India would be Section 3(d) of the Patents Act, which aims to prevent "evergreening," or the process of extending the term of a patent by minor modifications to a well-known product.[45]Section 3(d) holds that the patentability on new uses and properties of known substances will not be given if there is no substantial enhanced efficacy with the new form.[46]This has been the thorn in the flesh of combination vaccine biotechnology patents that though inherently novel could not be granted patent protection as these were held to be mere combinations or hybrids of known substances.[47]

Such a requirement may be somewhat problematic in the context of nanotechnology because most advances in that field require a redesign of the starting materials to create new nano-scale structures. Section 3(d) clearly prohibits

[39]*Farbewerke Hoechst v. Unichem Laboratories, AIR* 1969 Bom 255.
[40] Eloshway Charles R., *Nanotechnology-Related Issues at the United States Patent and Trademark Office*, *Community Res. & Dev. Info. Serv.*, Dec. 2006.
[41]*Novartis AG v. Union of India,* W.P. No. 24754 of 2006 and W.P. No. 24759 of 2006.
[42]Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299.
[43]The Patents Act, No. 39 of 1970, § 2(j), India Code (1970).
[44] Id. § 2(ja).
[45]Id. § 3(d).
[46]Id.
[47]*Novartis AG v. Union of India*, W.P. No. 24754 of 2006 and W.P. No. 24759 of 2006.

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patentability of "particle size," when modification only results in significant change in the physical properties of the material vis-`a-vis its utility[48]. This is an undeniably harsh interpretation that threatens to stifle innovations that incorporate size reduction to the nano-scale, even though those changes may relate to improvements in performance or new applications. Although the courts have not yet considered a case under India's litigation on nanotechnology, evergreening cases have seen the courts take a very strict view of Section 3(d). This could therefore suggest that patents concerning nanotechnology will face similar scrutiny. Being an inter-disciplinary field of research, nanotechnology presents a critical need for this technology-neutral patent law to be amended so as to meet the different issues arising from this field.Therefore, policy interventions in special provisions tailored for nanotechnology should be taken so that unwarranted challenges are not brought on when these inventions reach the market.The Indian Patent Office should, therefore, interpret Section 3(d) in a balanced way for nanotechnology patents. If interpreted too strictly, innovation in technology may be stifled, particularly with such fields as nanotechnology where small improvements can result in significant technological advancement. Case-by-case evaluation in nanotechnology patents with broader impact from nanoscale modifications would thus be essential for promoting innovation and, simultaneously upholding the integrity of the patent system.There is another glaring weakness: namely, the weak institutional capacity of the Patent Office in India, especially about nanotechnology-related patents assessment. For the time being, there exists a scarcity of patent examiners possessing special knowledge on nanotechnology as such, which worsens matters further. Building these capacities is important so that patents relating to this complex area are examined efficiently without wasting much time. This department will be led by public-private partnerships in providing capacity building, training of patent examiners, and recruiting experts in nanotechnology. Assuming the training programs are modelled along the kind of search in prior art, it will adequately equip the examiners with experience in regard to nanoscale inventions.Furthermore, Indian Patent Office should devise a particular class separated for nanotechnology patents specifically, just as USPTO's 977 class, Y01N class of EPO, and the ZNM class of the Japan Patent Office. This way, examination becomes easy by putting nanotechnology patents into a class of its own and search for prior art becomes more efficient, and judgements regarding novel new inventions are far more improved in terms of novelty.India has the entire system of post-grant oppositions in the sense of Section 25(2) of the Patents Act whereby any interested party can oppose an issued patent.[49] Nevertheless, the effectiveness of the system regarding nanotechnology would depend upon the greater education of the public as well as that of the patent office toward details of nanotechnology.

II. CONCLUSION AND SUGGESTIONS

In recent times, nanotechnology patenting opened up many doors of great opportunity and challenges within the global intellectual property framework. As nanotechnology promises to revolutionize innovation in several fields, from medicine to electronics, along with many others, a proper and flexible patent system has become very much on the agenda. At the same time as the existing patent law often seems to fail to meet the difficulties and complexities behind such inventions.Some critical issues faced by nanoscale materials whose properties are entirely different from those macro-scale counterparts and it becomes difficult to determine novelty, non-obviousness, and industrial applicability. Overclaiming, patent thicketing, and complexities associated with enforcing selection inventions in nanotech patent has posed many challenges in patent system. Moreover, inseparability arises due to the inability to distinguish between infringement as well as the high cost involved in enforcing such advanced microscopy that prevents proper protection through patents.Perhaps the most significant additional obstacle in India is Section 3(d) of the Patent Act, which requires the "superior efficacy" of an invention-a standard of proof perhaps impossible to establish at the nanoscale. An inability to navigate the patent office's procedure for particularly complex applications of nanotechnology also underscores a need for greater institutional change as well as international cooperation.Patent regimes around the world will have to evolve for the distinctive needs of nanotechnology in the coming years. The reforms should provide more definition in terms of patentability, strengthen technical competencies of the patent examiners, and encourage cooperation among the patent offices.

[48]The Patents Act, No. 39 of 1970, § 3(d), India Code (1970).
[49]Id. § 25(2).