

I. Introduction

Nanotechnology is the term used to categorize technologies related to structures and devices that are most conveniently measured for size at the nanometer scale – a nanometer is one billionth of a meter.¹ Given this broad definition, many fields of science can be covered by the term and in theory any process able to take full control or to manipulate matter atom by atom or in clusters up to 100 nanometers is understood as part of nanotechnology. This classification represents the multi-disciplinary nature of the field, which is also confirmed by the broad use of these new structures in dissimilar areas such as material science, electronics, biology, chemistry, biomedicine, mechanics, and any combination of them.²

The field has experienced an accelerated development during the last 20 years. The newness of the topic, combined with the high potential of the technology in terms of capacity to impact people's lives and the business universe expected to be generated, has produced extensive discussions and controversy, inviting debate on the social, economic, ethical and legal aspects of nanotechnology, its development, implementation and use.³

The economic benefit that is promised to the owners, or those controlling the knowledge and inventions around nanotechnology, has encouraged them to follow aggressive strategies with the intention of obtaining exclusive benefits by the legal appropriation of those developments. This legal appropriation is partially pursued by the filing of patent applications.

One of the objectives of this Thesis is to analyze such strategies, particularly the way in which applicants are trying to get broad protection of their inventions and the impact this may generate in the possibility to promote further development of the technology by universities and other companies. The analysis will focus on how the patent system allows protection of basic and broad aspects of nanotechnology and

- 1 Jeremy J. Ramsden, *What is nanotechnology?* Nanotechnology Perceptions 1, 2005, p3–17.
- 2 A further definition of nanotechnology is provided by the European Patent Office (EPO): “The term nanotechnology covers entities with a controlled geometrical size of at least one functional component below 100 nanometers in one or more dimensions susceptible of making physical, chemical or biological effects available which are intrinsic to that size. It covers equipment and methods for controlled analysis, manipulation, processing, fabrication or measurement with a precision below 100 nanometres.” The definition is available at <http://www.epo.org/topics/issues/nanotechnology.html>, (last visited September, 2009).
- 3 Allhoff Fritz, *Nanotechnology & Society: Current and Emerging Ethical Issues*, Lin, Patrick, 2008.

whether these patents may in the future be declared invalid, when important patents will start being used to litigate among competitors.⁴

A further aspect of the Thesis will concentrate on how patentability requirements may be applied to the particularities and complexity of nanotechnological inventions and essentially on the considerations that patent applicants should take into account while prosecuting these patent applications at the patent office. Considerations on patentable subject matter, novelty and inventive step requirements will be covered.

Lastly, the Thesis is to elaborate on the general nature of patent law and its applicability to specific technology fields.⁵ In this regard, it will be shown how patent law has been applied in the past to solve problems generated by new and complex technologies, which have generated the same or similar concerns; how law will be applied to this new field in a way to keep the patent system useful for the objectives it pursues, and how these developments can help to answer the uncertainties that the patenting of nanotechnological inventions is generating. Also, an attempt to answer the question of how the current patent system can be used to protect both the generator's commercial interest and the consumer's right of accessibility to the progress of science will be made, focusing on the question whether the requirements of patentability need to be reinterpreted in view of the particularities of nanotechnology.

The assessment on patentability requirements will concentrate on nanotechnological inventions developed in the field of materials and surface science, as described by class Y01N in the International Classification System administered by the World Intellectual Property Organization (WIPO), an area which represents a substantial portion of the recently filed patent applications worldwide.⁶ This area includes important developments such as nanocomposite materials, carbon nanotubes, fullerenes, nanostructured materials and dendrimers.

- 4 *Principles for Nanotech Oversight*, ICTA, AFL-CIO, FoE, IUF, ETC Group, Third World Network, Loka Institute, July 2007, available at <http://www.icta.org/pubs/index.cfm> (last visited September, 2009).
- 5 For a general discussion on the theory that patent law is general in nature but specific when applied on particular technical fields see Dan L. Burk and Mark A. Lemley, *Is Patent Law Technology-Specific?*, UC Berkeley Public Law Research Paper No. 106; and Minnesota Public Law Research Paper No. 02-14, 2002.
- 6 The EPO has also developed a class under the European Classification System (ECLA) for nanotechnological inventions. This class is labeled as Y01N "Nanotechnology", with a subclass Y01N6/00: Nanotechnology for materials and surface science. A description is available at <http://v3.espacenet.com/eclasrch?ECLA=/espacenet/ecla/y01n/y01n.htm> (last visited September, 2009).