

Patenting in Nanotechnology: Study of Nanostructured Polymeric Materials

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ABSTRACT

In this work a study of technological tendencies in nanotechnology applied to polymeric materials sector was carried out, based on information extracted of patent documents. The patent office of USPTO (United States Patent Trademark Office) was used as a data source. The data were supplied via web, using several keywords. A mapping was made of the major countries contributing, types and year of patent deposition, application sectors, polymer types used, main additives and fillers incorporated to the polymeric matrices.

Keywords: Nanostructured polymers, patentment, nanotechnology, nanopolymer.

1 INTRODUCTION

The Nanotechnology is revolutionizing the world science, and possibilities to this area, that has as most important property its diversification. The nanotechnology objective is creating new materials and development of new products and process based on the increasing capacity to manipulate atoms and molecules. The areas of application for nanotechnology extend to practically all industrial and service sectors. The multiplicity of applications is immense and thus requires multidisciplinary knowledge, based on physics, chemistry, biology, the science and engineering of materials, and computer science, amongst others, which aim to extend the human capacity to manipulate matter all the way to the limits of the atom ^[1,2]. Currently exist initiatives for investment in nanotechnology in developed countries. Most of these countries possess well-structured scientific sectors in this area, with science programs which lobby the government to release funds for research, creating incentives for companies to use this technology in order to improve the performance of their products. ^[3] A lot of companies around the world apply their profits in nanotechnology, but it is on the United States where the most of this companies are located. On materials sector, the Nanotechnology potencial is immense. New polymeric nanostructured materials are being developed with better properties than existing products. Moreover, the production methods of these material will tend to pass through deep transformations. Clay types, like the montmorillonite, which Brazil has an extensive deposit, can be utilized to nanocomposites production. In economics terms, this initiative will cause an expressive impact, because the

polymeric materials industries moves billions dollars per year, representing one of the most important sectors of global economy. A lot of countries, including Brazil, have important high quality clay reserves which could be explored in applications for this area^[4-5].

The present work aims to undertake information monitoring in regard to nanostructured polymers, based on information derived from patent documents.

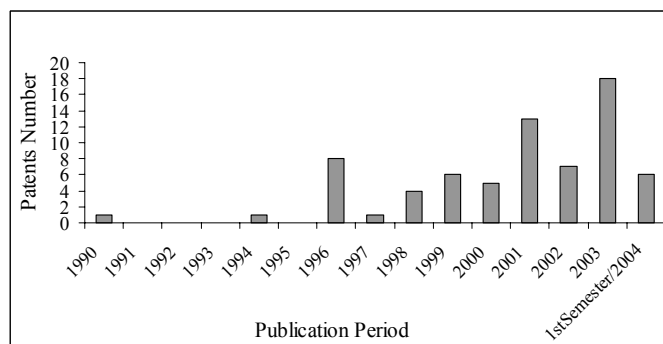
2 METODOLOGY

The source of data was the USPTO (United States Patent and Trademark Office) database, using the keyword option, which covers both patent abstracts and titles. Technological prospecting was undertaken in a volume of patents published between 1976 and June 2004. Research produced a total of 542 relevant patents, which were analyzed in order to map the main countries registering patents, the types of patents registered and the sectors in which these patents have application.

3 RESULTS AND DISCUSSION

Figure 1 presents the evolution of the register of patents in polymeric materials. The first patent related to a nanostructured polymeric material was registered in 1990 and second only in 1994. It had a great growth from 1996, standing out also the years of 2001 and 2003.

Figure 1



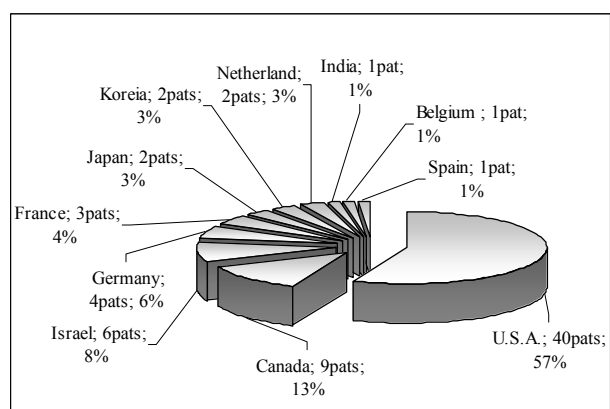
About the origin of these patents the main registering countries and the types of registering had been identified

such as Companies, Centers of Research, Universities and Physical People.

Registering Countries Distribution

Figure 2 presents a general overview of all the registering patents countries in last the 28 years. The distribution for registering countries pointed the United States as main responsible for the majority of the patents involving the nanostructured polymeric materials, answering for more than 55% of the total of these, followed by France with approximately 13% of the registered patents.

Figure 2



The great participation of the Companies can also be observed (more than 58% of performance); followed by the Universities, Centers of Research and Institutes (a little more than 38%); e Physical People (with a parcel approximately of 3%) respectively. The main identified Companies had been NanoSystem L.L.C (5 patents), company of the pharmaceutical sector, the Rhone-Poulenc Rorer S.(The 3 patents) and L'Oreal (3 patents), companies of the sector of pharmacos and cosmetics respectively.

Distribution by Applications

The sectors of applications of the n nanostructured polymeric materials are described in decreasing sequence of performance on Table 1. These sectors are defined separately, to understand each one of them better.

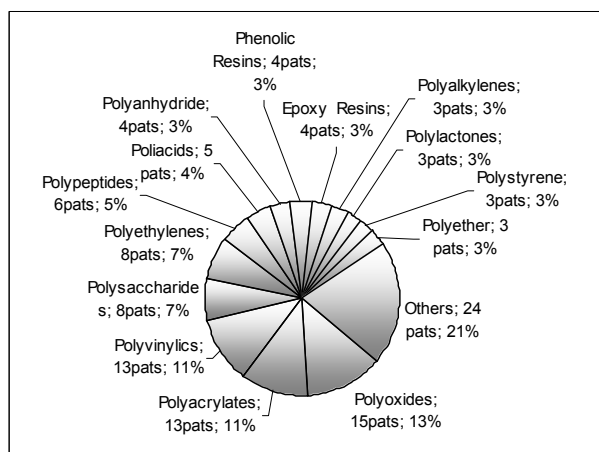
Application Sectors	N° of Registries
Polymeric Supports	21
Polymer Production Processes	15
Diagnostics and Therapies	10
Pharmaceuticals	9
Reparative Medicine and Dentistry	8
Process of Characterization of Specific Particles	7
Thin Films for Treating Surfaces	1

Table 1: Formatting summary for Nanotech manuscripts.

Polymers Type

Figure 3 presents overview of the main types of polymers identified with its respective percentages of participation and registering number. It can be observed that the more utilized polymers in the studied universe are the polyoxides ones, polyacrylates and the polyvinyl ones, that contribute with more than 35% of the registers involving material nanostructured polymeric materials.

Figure 3



Amongst the polyoxides, are distinguished, the ethylene polyoxides, propylene, ethylene-propylene, among others.

In the polyacrylates class can be found the poly (alkyl acrylates), polymethacrylate, poly(acrylic acid), whereas in the group of polyvinyl it is distinguished the poly(vinyl alcohol) and derivatives. About the polymers type, in many cases, to the polymeric matrix, other materials that act as additive and/or feeds are added. These materials, those are in nanometric scale, have as objective to supply a specific characteristic, always acting to promote improvements in the properties of the material. In the study, it can be observed the predominance of silicon and its derivatives in the composition of the polymeric materials.

4 CONCLUSION

From the study carried through in the period between 1976 and June of 2004, with analysis of 542 patents about Nanotechnology and 70 of nanostructured polymeric materials it can be gotten some conclusions, such as: The first patents involving Nanotechnology had started to be published in the half of the decade of 80, having from now on an increasing increase in the number of registering. Patents involving nanostructured polymeric materials had only appeared in the decade of 90. It is observed that more than 70% of the patents on nanostructured polymeric materials had been registered by the United States, France and Germany. About the registering types, the Companies had the biggest number of registers, followed by the Universities, Research Centers, Institutes and Physical People. Nanosystem S., specialized American company in the production of pharmacos, was the one that presented greater number of register of patents in nanostructured polymeric materials. About the applications, it is possible to observe that the polymeric supports sector and the processes of polymer manufacture are the biggest sectors, acting with more than 50% of the total. In relation to polymers, it is observed that the most used in nanostructured materials are the polyoxides ones, polyacrylates, polyvinyl, polysaccharides and polyethylenes, corresponding to a percentage of approximately 50% of the analyzed patents. About the question of the main materials incorporated in the polymeric matrices, the silicon followed by chromium and carbon is distinguished. Finally, the great potential of nanostructured polymers in diverse areas of the knowledge of the Nanotechnology could be evidenced.

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