Nanotechnology Patent Mapping

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ABSTRACT

Over the last years an increase in filings of patent applications related to nanotechnology has been observed at the European Patent Office (EPO). A strategy was devised to prepare for potential impacts of this interdisciplinary emerging technology on workload per technical field, classification and search. First results are the agreement within the EPO on a definition of nanotechnology and the creation of a tagging system (Y01N).

The introduction of these tags for nanotechnology patent applications facilitates interdisciplinary searches in this area within the extensive patent databases of the EPO. We present public access possibilities to these databases and search strategies using the Y01N tagging system. This tagging also enables monitoring of patenting trends in nanotechnology and extraction of valuable patent indicators to support evidence based strategic decision making. We present results using the Y01N tagging system to compare nanotechnology patent activities in Europe.

Keywords: EPO, patents, nanotechnology, monitoring, search

1 INTRODUCTION

Emerging technologies with high growth rates can have a considerable impact on the EPO, like the examples of biotechnology and telecommunication have shown in the past.

The interdisciplinary nature of nanotechnology poses specific challenges to a patent office since nanotechnology patents are scattered over many technical fields. Important issues such as search-file allocation, multidisciplinary classification schemes, efficient and complete prior art searches, substantive examination and examiner recruitment consequently require the collaboration of examiners from many different technical areas. With this in mind, the EPO is developing strategies to be prepared for emerging technologies in an early stage in order to ensure that sufficient examiners with relevant technical and legal competence are available in areas with a strong increase in patent filings.

First, the methodology for creating an in-house monitoring and multidisciplinary tagging code Y01N for nanotechnology patents as part of this strategy is outlined. We also present results with respect to identifying and tagging nanotechnology based patents as well as data showing current patent trends in nanotechnology areas. In addition, some search strategies using the Y01N tagging system in combination with the EPO internet esp@acenet® interface [1] are presented.

2 METHODOLOGY: IDENTIFYING NANOTECHNOLOGY-RELATED PATENTS

2.1 The definition of nanotechnology? [2]

Patent offices worldwide use a system for classifying documents using codes, which is called IPC (International Patent Classification). For example, the IPC code B82B relates to Nanotechnology. In addition, patent offices have often also developed their own specific coding and retrieval means The EPO, for example, uses a classification scheme called ECLA, which is essentially a refined version of the IPC. In order to develop and use certain classification codes, however, it must be clear which type of technologies are covered by them, i.e., one must provide a definition of the technology that should be in the document in order for it to receive such a code.

In 2003 the EPO has created a Nanotechnology Working Group (NTWG) with the aim of confronting the challenges posed by nanotechnology. The first task of the NTWG was to find an EPO nanotechnology definition for trend watching nanotechnology patents and the facilitation of interdisciplinary search. Such a definition had to match closely the definitions used in the majority of industrial R&D programs and by governmental funding programs of major economies as increases in patent filings are to be expected in technologies in which nanotech R&D efforts are concentrated.

Choosing too restrictive a definition would leave essential technological developments outside of the scope of our nanotechnology trend watching. A typical example of such a restricted definition is B82B, the sole subclass in ECLA (European classification system) and IPC of the class B82 "Nanotechnology". Not more than 145 patent families are classified in ECLA B82B at present since B82B merely encompasses a single aspect of nanotechnology, namely manipulating individual atoms or discrete groups of atoms in a controlled way in order to manufacture ordered structures. This definition would not enable trend-watching and interdisciplinary search.

A very broad definition, however, would make any result meaningless as virtually any "small" technology would be labeled "nano". The NTWG was advised by VDI-TZ [3] in creating the following definition for nano-technology which serves the EPO for monitoring new technological developments in nanotechnology:

"The term nanotechnology covers entities with a controlled geometrical size of at least one functional component below 100 nanometres (nm) in one or more dimensions susceptible to make 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"

2.2 Nanotechnology tagging [2].

The EPO has created a new tag "Y01N" for Nanotechnology in ECLA, which is applied as an additional tag to the 56 million documents represented in the EPO databases. The scope of this tag Y01N corresponds to the definition outlined in the previous section.

Technologies that fall within the scope of the definition outlined in the previous section and which are considered by EPO experts as new technological developments are tagged with the Y01N code.

An extensive keyword search in abstract and full text patent databases using known synonyms for nano-technologies in combination with keywords with the prefix "nano" in the indexes of the databases (obviously excluding "noisy" words like nanometres and nanoseconds) gave very poor results. Manual checks of a sample of the results indicated that a high percentage of the retrieved documents did not fall within the scope of the definition of Y01N, which is not surprising as the prefix "nano" has become increasingly popular in recent years.

The authors experience is that a detailed knowledge of the technical field and an in-depth understanding of the classification system used in a specific technical field are a prerequisite to retrieving reliable data from patent databases. The NTWG therefore assumed that using the technical and classification knowledge of examiners would provide a good dataset for trend watching in nano-technology.

Experts in areas of nanotechnology were identified among the 3500 patent examiners in the EPO. These were asked to identify relevant ECLA classes already dealing with nanotechnology, as well as other experts in areas of interdisciplinary overlap, who in turn were again consulted, etc. By using this iterative process and involving VDI-TZ for feedback, a list of three categories of ECLA entries was identified entries (i.e. list of technologies):

I. ECLA entries for which all classified documents fall within the scope of Y01N

II. ECLA entries for which a part of the classified documents fall within the scope of Y01N

III. ECLA entries for which (part of) the classified documents fall under the definition of chapter 2.1, but the technology is mature and is not labeled "nanotechnology" by the scientific community and by funding agencies.

Y01N is subdivided in six codes Y01N2 to Y01N12, whereby each code brings nanotechnologies of similar technical background together. Four of these codes derive from an European Commission expert consultation [4], the additional Y01N main groups were proposed by EPO experts. A summary of these codes is given in Table 1.

Code	Title
Y01N2	Nanobiotechnology
Y01N4	Nanotechnology for information processing, storage and transmission
Y01N6	Nanotechnology for materials and surface science
Y01N8	Nanotechnology for interacting, sensing or actuating
Y01N10	Nano-optics
Y01N12	Nanomagnetics

Table 1: EPO nanotechnology tagging codes

The Y01N tagging codes are allocated to a patent in two ways:

a) automatically for each document which is classified in one of the ECLA entries of the first list (category I)).

b) At least one senior classifier with a background in nanotechnology has been assigned for each of the Y01N2-Y01N12 codes. Each EPO classifier of any technical area can send individual nanotechnology documents to one of these Y01N2-Y01N12 classifiers for *ad hoc* tagging.

Hence the Y01N nanotechnology tag consists of all documents which are either classified in one of the type I ECLA classes or which are manually tagged by Y01N senior classifiers.

Y01N is continuously updated and improved. As soon as a category II ECLA entry is reorganized and refined, the newly created nanotechnology ECLA subclass is considered a type I subclass and all documents classified therein are automatically added to the Y01N tag. More detailed information on the tagging method and contents of Y01N2 to Y01N12 can be found in [2].

3 PATENT TRENDS

At present around 29000 patent families (a patent family is a group of equivalent patent applications which have been published in several countries for the same invention)

have been tagged as nanotechnology by receiving one or more of the Y01N2 to Y01N12 tags. These families represent 87000 patent documents. In addition 20000 scientific papers have also been tagged. In total, therefore, 107000 documents have been tagged as nanotechnology by the EPO at present. The published patent documents are divided over the different areas as indicated in Figure 1.

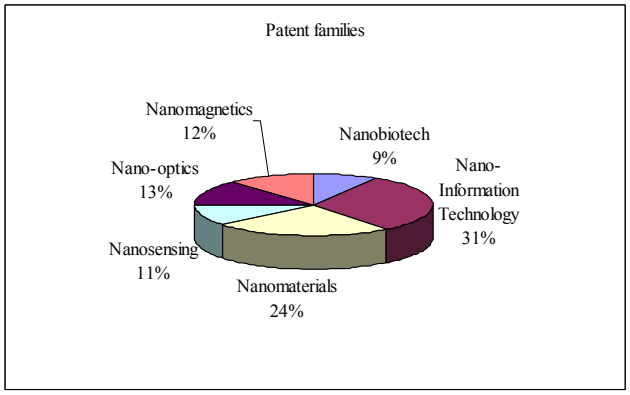

Figure 1: Distribution of Nanotech patent documents

Using the Y01N tags, it is possible to extract global as well as regional patenting information and trends from the EPO databases. In this paper, we focus on published European Patent applications (EP applications).

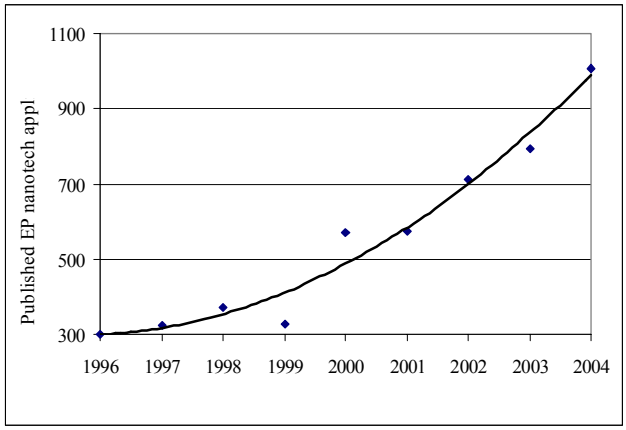

Figure 2: Published EP nanotech applications per year

In Figure 2, the amount of published nanotechnology related European patent applications per year, based on Y01N-tagging, is given. A clear upward trend can be observed.

In Figure 3, the breakdown of all published European patent applications per country of origin of inventor/applicant is shown. It can be seen that inventors/applicants from the Europe, Japan and the USA are responsible for 95% of the total of published European patent applications in the area of nanotechnology. They are each roughly responsible for one-third of the nanotechnology applications in Europe.

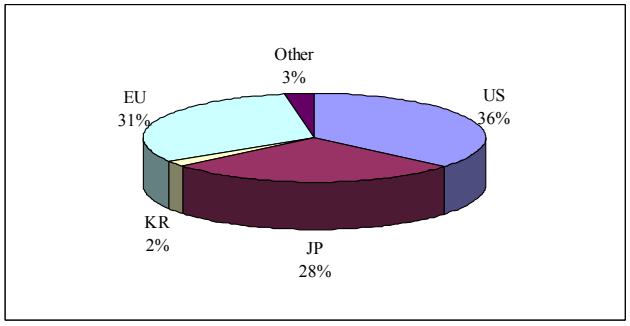

Figure 3: Origin of inventor/ applicant

4 Y01N AND esp@cenet®

Esp@cenet® (http://ep.espacenet.com), the free internet search engine provided by the EPO, gives access to 56 million published patent documents word-wide.

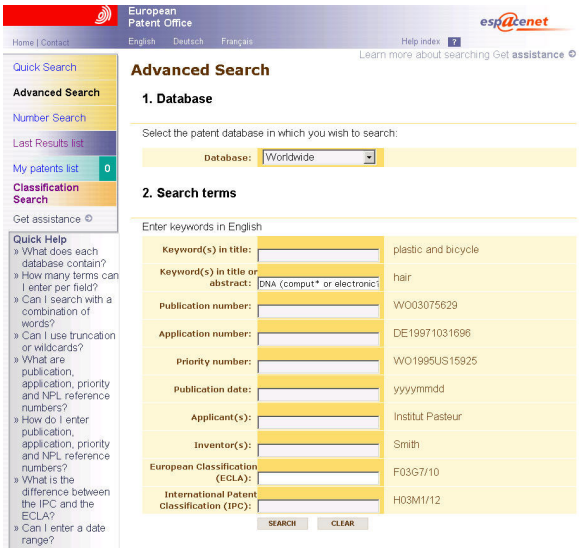

Figure 4: Esp@cenet Search Engine

Since January 2006, it is possible to use the Y01N code to retrieve patent documents of interest which are specifically related to nanotechnology.

4.1 A case study: "DNA computers"

A possible strategy for searching patent documents relating to DNA computers is entering the query:

DNA (comput* OR electronic?)

into the "Keyword(s) in the title or abstract" field ("*" stands for a string of characters of any length and that "?" stands for zero or one character).

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The result will be (at time of writing of this paper) 574 hits of patent families having these words in the abstract or title. Many of these documents, however, relate to computing DNA sequences from sequencing data, i.e., only a minor portion of the results is relevant for DNA computers.

Combining this strategy with the tagging code

Y01N4

in the "European Classification (ECLA)" field, gives 64 patent families as result, which are relevant for DNA computers.

A closer look at selected documents reveals that the most relevant documents carry ECLA class G06N3/12D. Clicking on this class in the "EC:" field of the results yields the following information on screen (Figure 5):

Figure 5: Definition of class G06N3/12D

Now searching again with "G06N3/12D" in the ECLA-field yields 181 patent families where the words DNA and computer are not always explicitly present in the title or the abstract, but which all relate to DNA computers and computing,

Using the Y01N tagging code in combination with keywords, and possibly supplemented with other ECLA codes, improves the results for nanotechnology related searches in esp@cenet.

5 CONCLUSIONS

In order to be able to cope with a growing amount of patent applications on the one hand and to provide useful information to the users of the patent system on the other hand, the European Patent Office has created the Y01N tagging codes, with which 87000 patent documents have been visibly identified as relating to nanotechnology

These codes are useful to aid EPO examiners in retrieving interdisciplinary nanotechnology documents in and to allow trend-watching, useful for allocation of resources within the EPO.

They may also provide relevant information to third parties about world-wide or regional patterns in nanotechnology patenting.

The tagged nanotechnology documents are searchable and available on-line free of charge via internet. The use of the Y01N-tag increases the relevance of nanotechnology patent searches. An initial search using Y01N can also serve as a good basis for obtaining relevant other ECLA classes for searching within the EPO's extensive world-wide database of patent documents.

The completeness of the EPO's database in terms of coverage of all major world-wide patent systems, combined with the precision of the Y01N codes may prove to be a valuable tool for "state-of-the-art" or freedom-to-operate" searches in nanotechnology areas.

DISCLAIMER

The opinions expressed in this paper are those of the authors. They should not be considered as necessarily the policy of the European Patent Office (EPO), or imply any commitment by the EPO to any particular course of action.

REFERENCES

[1] http://ep.espacenet.com

[2] M. Scheu et al., World Patent Information, 28, 204-211 (2006)

[3] VDI-TZ (http://www.vdi.de/vdi/vditz/eng.html) is a major German funding agency for nanotechnology commissioned by the Federal Ministry of Education and Research and a national contact point for nanotechnology for the European Commission.

[4] "Nanotechnology Expert Group and Eurotech Data: Mapping Excellence in Nanotechnologies; preparatory study" http://europa.eu.int/comm/research/era/pdf/nanoexpertgroupreport.pdf