BUSINESS CONSULTING BASED ON PATENT ANALYTICS

AI and other tools & technics. Experience of the Russian Patent Office

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Tools & Technics

- knowledge formalization
- topic modelling
- clusterisation (model-driven, patent structure – driven)
- machine learning
- similarity search based on semantic technologies
- subject-action-object
# Products & Services

## Strategic Level

<table>
<thead>
<tr>
<th>Domain-specific patent landscape</th>
<th>Comprehensive study enriched by subject matter experts: trends, technical analysis, strategies, geography, companies, citations, legal status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent technology intelligence</td>
<td>Deep profiling of companies, technologies, products and services in specific technology area</td>
</tr>
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</table>

## Operational Level

<table>
<thead>
<tr>
<th>R&amp;D entourage</th>
<th>R&amp;D prioritization based on a set of business-valued and patent analytics indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of company’ patent portfolio, potential of commercialisation</td>
<td>Patent portfolio segmentation: by technology areas: express patent landscapes by patent strength: groups of importance, recommendations for commercialisation</td>
</tr>
<tr>
<td>Patent addendum</td>
<td>Patent analytics add-on to the services of 3rd party consulting companies</td>
</tr>
</tbody>
</table>
What questions patent analytics could answer?

• we are going to build a refinery, how do we understand that we are offered the best technologies and that our technologies are properly protected?

• we have a large portfolio of patents, how do we understand which of them are valuable, and which ones can be stopped supporting?

• in our technological areas there are a lot of competing companies, how do we understand what technologies they develop?

• we are offered to invest hundreds of projects a year, how do we understand which ones we need to finance?

• whom we should cooperate with, whom to acquire, what licenses to buy?

• ...
Strategic Level.
Domain-specific patent landscape
Research theme decomposition

Catalysts

- Form of catalyst
  - extrusion
  - electric explosion
  - peptisation
  - ...

- Method of producing
  - Cobalt
  - Nickel
  - Molybdenum
  - ...

- Problem areas
  - extended lifetime
  - energy efficiency
  - desulphurisation
  - ...

Cross-analysis:
1. Time-scale
2. on problem areas
Extensive involvement of experts (in-house and external)

detailed technical analysis and expert interpretation by 3 groups of experts

the growth since 2010 of hydrocracking catalysts containing zeolites and aluminosilicates

1.1.1 – Содержит никель  
1.1.2 – Содержит молибден  
1.1.3 – Содержит кобальт

1.2.1 – Содержит цеолит  
1.2.2 – Содержит алюмосиликат  
1.2.3 – Содержит Zr, Ge, B

1.3.1 – Оксид кремния  
1.3.2 – Оксид Алюминия  
1.3.3 – Оксид других металлов (оксид Ti)
Technological focus of companies' attention

патенты, имеющие технические решения проблемных областей, например, «высокооктановый бензин». Американская компания **Chevron** также имеет определенную специализацию в разработках. Основные области патентования характеризуют разработки в области кристаллических алюмосиликатов (цеолитов), в частности «цеолитов Y-типа», «аморфных алюмосиликатов» и «новых кристаллических цеолитов». Особое внимание отводится катализаторам, содержащим «благородные металлы». Другая американская компания ExxonMobil равномерно представлена практически
Strategic Level.
Patent technology intelligence
Goal

- a comprehensive study of modern technologies and products of leading companies along several rather narrow technological areas (for example, “alkylation”)
- research of patent documents, scientific papers and the Internet

Key results

- technological profiling of 103 companies in the field of oil refinery
- 294 technologies that the company develops (produces):
  - level of maturity for company’s technologies
  - key technical solutions and patenting features specific to a particular company
- 233 products that companies put on the global markets:
  - position relative to other products of technological direction
  - place of product in the company product line
  - key advantages and features of the product
- extensive expert description of the methods of patenting and key features of companies’ technologies
## Example Results for one of Albemarle Corporation Technology Maturity Level

<table>
<thead>
<tr>
<th>Technology</th>
<th>Patent Knowledge</th>
<th>Scientific Paper Knowledge</th>
<th>Internet Knowledge</th>
<th>Maturity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADZT-100 zeolite</td>
<td>there is an application for the composition or method of production of the final product; there are separate patents for technology elements or related technologies (for method, catalyst, etc.); there is a patent for the product or the method of its production; there is an application for the technological process with the new product; there are patents for associated technological processes.</td>
<td>Photo-spectroscopy of mixtures of catalyst particles reveals their age and type (2016); Breakthrough characterization methods for evaluation of metals poisoning in FCC catalyst (2016); Take ACTION™ to maximize distillate and alkylation feed from your FCC unit (2014); Process and catalysis factors to maximise propylene output (2012); Microscopic insight into the deactivation process of individual cracking catalyst particles with basic sulfur components (2012); Staining of fluid-catalytic-cracking catalysts: Localising Brønsted acidity within a single catalyst particle (2012); Catalytic activity in individual cracking catalyst particles imaged throughout different life stages by selective staining (2011); Choosing the advanced option (2010); Bottom of the barrel economics (2010); Comparisons of FCC product yields and qualities between reactors using Canadian heavy feeds (2005); Performance of FCC catalysts prepared with sub-micron y zeolite (2004); Catalyst assembly technology in FCC. Part II: The influence of fresh and contaminant-affected catalyst structure on FCC performance (2001); Heavy oil processing. Catalysts (2000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- the product (technology) is offered on the market;
- there are several products based on one technology

stack of technologies (technology tree)
Dive into products

Complex analysis of the company's product line

<table>
<thead>
<tr>
<th>2.1.3.4. Albemarle</th>
<th>ACTION</th>
<th>CORAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMBER</td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
</tr>
<tr>
<td>GO-ULTRA</td>
<td><img src="image3" alt="Graph" /></td>
<td><img src="image4" alt="Graph" /></td>
</tr>
</tbody>
</table>

**CORAL™ FCC catalysts – Improving residue FCC unit performance through enhanced catalyst accessibility**

**Mass transfer limitations:**

Many FCC units experience losses in conversion and bottoms selectivity as a result of mass transfer limitations. These are due to the problems that high-molecular-weight, sterically hindered feed molecules experience when diffusing into catalyst particles.

Albemarle offers the breakthrough catalyst CORAL to overcome this problem, especially in residue FCC units.

Figures 1 and 2 show the presence of an inflection point in the accessibility curves. These yield shifts are consistent for all mass transfer-limited operations. The absolute value of the inflection point differs unit by unit, but the trends are consistent. For this FCC unit, the critical accessibility, shown by the dashed line, is about 4.5.
Patent Search & Analytics. Proposal for the broader AI coverage
Catalytic hydroconversion of the extraction residue from Naomaohu lignite over an active and separable magnetic solid superbase (Article)

Zhang, M.a, Wei, X.-Y.ab, Yang, Z.a, Teng, D.-G.a, Xue, Y.a, Meng, D.-W.a, Zong, Z.-M.a

Key Laboratory of Coal Processing and Efficient Utilization, Ministry of Education, China University of Mining & Technology, Xuzhou, Jiangsu, China
State Key Laboratory of High-efficiency Coal Utilization and Green Chemical Engineering, Ningxia University, Yinchuan, Ningxia, China

Краткое описание

A highly active magnetic solid superbase (MSSB) was prepared by impregnating Mg$_2$Si onto γ-Al$_2$O$_3$-coated ferriodic oxide nanoparticles via one-pot synthesis method and successfully applied in the catalytic hydroconversion (CHC) of the extraction residue (ER) from Naomaohu lignite. Large amounts of chain alkanes and arenes were detected in the soluble portion (SP) from the non-catalytic hydroconversion of the ER, while oxygen-containing organic compounds are predominant in the SP from the CHC of the ER, indicating that oxygen has played a key role in the CHC. 1,3-Dibenzylbenzene was used as the lignite-related model compound to evaluate the catalytic activity of MSSB. The results show subsequent H$^+$ transfer, leading to the cleavage of C-O bridged bonds. © 2018 Elsevier Ltd

Reaxys Database Information

View Compounds

ключевые слова автора

Catalytic hydroconversion, C-O bridged bonds, Magnetic solid superbase, Naomaohu lignite

включенные в указатель ключевые слова

Engineering controlled terms: Alumina, Aluminum oxide, Catalyst activity, Extraction, Lignite, Magnesium compounds, Nanomagnetics, Synthesis (chemical)

Compounds keywords: Extraction residue, Ferriodic oxides, Hydroconversion, Large amounts, Magnetic solids, Model compound, Non-catalytic, Oxygen

Engineering main heading: Hydrocracking
| Stage 1 | Develop an extension to the ST.96 standard: ‘domain-specific key terms’ (XML4IP)  
| Disseminate standard extension among patent analytics providers and national patent offices |

| Stage 2 | Usage of the new standard extension by patent analytics providers (non-harmonised, with their own principles of keywords filling)  
| Development of the tools oriented to extended section processing  
| Promotion of the new technology-valued section of patent documents through patent analytics community  
| Research study (WIPO, providers, patent offices): ‘Mature approach for usage of subject-oriented taxonomies’ (oil & gas, pharma, medicine, energy etc.). Research consists of work packages, main deliverables:  
| the set of domain-specific taxonomies (10-15 taxonomies linked to 35 WIPO technology areas)  
| methodology guidelines ‘how to process patent documents and define taxonomy coverage for a patent document’ |

| Stage 3 | Usage of the new standard extension by patent analytics providers and national patent offices (harmonised, based on methodology guidelines and a set of pre-defined trusted taxonomies)  
| Elaboration on full coverage of technological areas |
# Enrichment of patent documents

## Current state

- **Documents**: Patent Document XML specification (ST.96)
- **Support**: bibliography

## Stage 1

- **Documents**: Patent Document XML specification (ST.96)
- **Support**: bibliography

- **ST.96 Standard extension**

## Stage 2

- **Documents**: Patent Document XML specification (ST.96)
- **Support**: extended (bibliography + keywords)

- **Research study deliverables**

## Stage 3

- **Documents**: Patent Document XML specification (ST.96)
- **Support**: extended (bibliography + keywords)

- **Taxonomies & guidelines**

## Usages

- **Classic**: dissemination of the standard
- **Non-harmonised keywords filling**
- **Harmonised keywords filling** based on guidelines and pre-defined taxonomies

## Main goal

- Enrich patent documents with domain-specific data valuable for refined search & analysis

## Effects

- Increase of quality – more accurate determination of patent document technology topics
- Reduction of the resource-intensive efforts: time and cost
- Widening of the functions and possible usage scenarios of the patent analytics tools
- Stimulation of the processing tools development
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