Ion Exchange Resins – Purified water for the world

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Head of Business Unit Ion Exchange Resins
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Agenda

- ION – Business overview
- Growth drivers
- New technologies and investments
- Outlook
Ion Exchange Resins – The water business

ION – Business overview

- **Facts**
  - Sales: <€200 m
  - Employees: ~500
  - Customers: >1,500
  - Customer industries: >20

- **Products & brands**
  - Products: ~250
  - Brand: [LEWATT]

- **Markets & competition**
  - Market position: among top 3 global players
  - Oligopolistic industry structures
  - Competitors: Dow/Rohm & Haas, Mitsubishi Chemicals
ION production process for application variety

**Production process**
- Suspension of monomer droplets
- Polymerization: from droplets to small polymer beads which are made up of a network of polymer chains
- Functional groups are applied to the beads

**Product properties**
- Ability to exchange ions
- Absorption of molecules on polymer surfaces
- Acceleration of reactions by catalysis

**Different functional groups for different applications**

<table>
<thead>
<tr>
<th>Purification</th>
<th>Catalysis</th>
<th>Softening</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Purification functional group" /></td>
<td><img src="image" alt="Catalysis functional group" /></td>
<td><img src="image" alt="Softening functional group" /></td>
</tr>
</tbody>
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CHAN - N

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CH_2\cdot CO_2Na
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\[
CH_2\cdot CO_2Na
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\[
SO_3H
\]

\[
CO_2H
\]

ION – Various customer industries for water treatment with energy and beverages as main application areas

**Sales distribution by industry**
- Energy: 36%
- Beverages: 20%
- Chemicals: 15%
- Water: 13%
- E/E: 11%
- Others: 5%

**Experienced solution provider**
- One of the world’s leading producers of ion exchange resins for treatment of liquids
- Providing premium products for more than 500 applications
- More than 70 years know-how in all technical application fields
- New business field of membrane filtration technology

Source: LANXESS estimates
Tailor-made solutions for over 500 applications

### Applications in ION key industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy (nuclear and other power plants)</strong></td>
<td>- Softening and high purity demineralization for boiler feed water&lt;br&gt;- Prevention of calcium deposits, corrosion, incrustations and precipitation</td>
</tr>
<tr>
<td><strong>Beverages</strong></td>
<td>- Softening: reduction dissolved calcium, magnesium, etc. in water and replacing them with non-hardness ions (e.g. cartridges for household water pitchers)&lt;br&gt;- Decolorization: e.g. removal of mineral salts from sugar and binding color impurities for creating pure-white granulated sugar for industrial use (others e.g. color free apple juice)</td>
</tr>
<tr>
<td><strong>Electric / Electronics</strong></td>
<td>- Demineralization / polishing: ultra pure water (UPW) for chip manufacturing</td>
</tr>
<tr>
<td><strong>Chemicals</strong></td>
<td>- Catalysis: ion exchange resins as catalysts used in production of plastics&lt;br&gt;- Mining: recovery, purification and separation of metals like gold, copper, nickel and cobalt from liquids</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>- Ground water remediation: removal of impurities like arsenic, chrome and uranium&lt;br&gt;- Cleaning industrial effluent: removal of heavy metal ions and organic pollutants from waste water</td>
</tr>
</tbody>
</table>

ION – Global set up for direct access to customers worldwide

#### Globally positioned with production sites and technical centers

- **Production sites**
  - Bitterfeld, Germany (ion exchange resins and membrane technology*)
  - Leverkusen, Germany
  - Jhagadia**, India

- **Technical service centers**
  - Birmingham, USA
  - Shanghai, China
  - Toyohashi, Japan

* Production starts 2011; ** Production starts end of 2010
Growth driver megatrend water: Ion Exchange Resins ensures access to limited resource water

Megatrend Water

Growing world population and environmental pollution will further limit access to clean water

LANXESS ION products

- Better ground and waste-water decontamination
- Ensure access to drinking water
- Ensure availability of water for special applications

Safe and clean water and sanitation declared as a human right
(United Nations, 2010)
Expected scarcity of clean water as essential global challenge

Projected shortfall for clean water

Global water supply & demand [bn m³]

- Shortfall 2,700bn m³
- 2010e clean water supply: 4,200bn m³
- Current demand: 4,500bn m³
- 2030e demand: 6,900bn m³

- 47 countries (one third of the world’s population) suffer from moderate or severe water stress
- Expected global shortfall for clean water of ~40% until 2030
- In 2025 ~4.8 bn people will only have access to polluted water resources
- Emerging countries are especially affected with Indian water shortfall ~50%

Increasing demand for water

- Domestic
- Industry
- Agriculture

Asian energy sector with high water demand for industrial use

Water demand for industrial use

Greater China energy industry growth [sales, € bn]

- Greatest China energy industry growth: 2000-2020e
- CAGR: ~11%

Wastewater reuse as main challenge

- Fast industrialization in Asian countries goes in parallel with increasing demand for industrial water
- Already significant and increasing water pollution in Asia intensifies need for water treatment technologies
- Highest industrial water demand comes from energy sector mainly by increasing need for power generation, caused by urbanization


Source: Global Insight, 2010
Expansion of nuclear power triggers risen need for water treatment in plants

**Worldwide growth of nuclear power use**

- Increasing use of nuclear power in industrial nations and emerging countries due to higher energy demand
- USA as the world’s largest producer of nuclear power will be displaced by China in 2030
- Nuclear power industry as most demanding ion exchange resins consumer in the energy generation industry:
  - high grades of ion exchange resins
  - high frequency of replacement necessary
  - recovery of nuclides

**China with strong increase for cartridge solutions**

- Rising middle class, especially in emerging countries, with growing consumption of water in drinking quality (household and beverages)
- Opportunity for cartridge and membrane solutions
- Acceptable threshold levels of impurities for arsenic in water are constantly being adjusted downward
  - Europe as leader: <10 ppb* acc. to WHO
  - China: often >50 ppb*
- Mid-term, China is expected to adopt WHO guidelines
- Water purifier to become main driver for drinking water supply in households in China

Source: WNA Nuclear Century Outlook Data, 2010

Source: China drinking water industry report, 2009-2010; Global Insight, 2010; * parts per billion
In developing countries, estimated 90% of all sewage is still discharged untreated directly into rivers, lakes and oceans.

Fastest growth expected in Asia-Pacific, especially in China and India, driven by:
- growing population
- increasing urbanization
- rising energy consumption

Additional factors supporting global growth are:
- growing health concerns
- rapid industrialization and contamination of water sources
- stricter regulations for drinking/waste water
- climate change

Strong demand for water treatment with Asia driving growth

**Worldwide ion exchange resins demand**

<table>
<thead>
<tr>
<th>Region</th>
<th>2007</th>
<th>2010e</th>
<th>2015e</th>
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<tbody>
<tr>
<td>RoW</td>
<td>~860</td>
<td>~950</td>
<td>~1,150</td>
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<tr>
<td>APAC</td>
<td></td>
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<td></td>
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<tr>
<td>Europe</td>
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<td></td>
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<tr>
<td>United States</td>
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CAGR: ~4%

**Increasing need for water technology**

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<td>New technologies and investments</td>
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ION – Driving innovations for new standards in water technology

**Main product properties**

**Nuclear**
- Higher resin stability for longer lifetime

**Mining**
- Separation of metal and new bead size for better industrial use

**Arsenic removal**
- Chemical functionality for highly selective arsenic removal

**Ultra Pure Water (UPW)**
- Pushing back the impurity limit

**Biofuels**
- Industrial solutions for most biofuels

Membrane technology for high-quality water treatment fits perfectly in ION portfolio

**ION – “one stop shop” with membrane technology**

Membranes: acting as a barrier for substances dissolved in the water

**Technology properties**

- Membrane technology for additional high-quality water treatment
- Global market size for membrane technology ~€1 bn, expected to grow ~10% p.a.
- Membrane technology is complementary to ion exchange resins filtration processes:
  - Membranes offer additional filtration, e.g. nitrates, heavy metals, pesticides, herbicides, viruses, bacteria
  - Membrane filtration is physical vs. ion exchange resins is chemical based

MF: Micro Filtration, UF: Ultra Filtration, NF: Nano Filtration, RO: Reverse Osmosis
ION – Investment in membrane technology for access to market with high growth potential

**New plant in Bitterfeld, Germany**
- €30 m investment in new, 2nd ION facility in Bitterfeld, Germany
- Development and production of new membrane filtration technology
- Creation of 200 jobs on a long-term basis
- Groundbreaking January 2010; new plant taken into operation for pilot and development phase end of 2010; first products to be launched end of 2011

ION – Investment in India for direct access to strong growing emerging markets

**New plant in Jhagadia, India**
- First mover in India; no western ion exchange company with production sites in India so far
- €35 m investment in plant in Jhagadia, Gujarat, India
- Construction well on schedule, start-up in Q4 2010
- 250 workers employed by LANXESS on site
- Most modern plant of its kind in Asia
- German standards regarding sustainability, safety and product quality on Jhagadia site
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ION – Leading technologies and excellent market position enable profitable growth in important water market

- Megatrend water in emerging countries drives long-term growth of ION
- Targeted investments in attractive markets further strengthen ION global position
- Value generation through strategic positioning as a full service provider with “one stop shop”

- Knowledge and technology leadership as a main competitive advantage and base for strong long-term customer relations
- Focus on premium application areas with premium products

- High-quality, balanced specialty and consumer product portfolio
- Strong R&D and innovation driver in further product diversification
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