LANXESS Heat Transfer Fluids
Diphyl®

Dr. Wolfgang Podestà & Mercedes Bayer
Leverkusen, 2017
LANXESS – A globally operating specialty chemicals company

Specialty chemicals company
- Spin-off from Bayer in 2004
- Specialty chemicals portfolio: plastics, rubber, intermediates and specialty chemicals

Global success story
- 75 sites worldwide
- Approximately 19,200 employees in 25 countries
- Global sales of EUR ~9.2 billion in 2016*

Strategy of profitability and resilience
- Enhancing its leading position in mid-sized markets

*Combined sales of LANXESS and Chemtura in 2016
Global presence

Sales per region (2016, in %)

- Asia/Pacific: 31%
- Latin America: 10%
- North America: 10%
- EMEA (without Germany): 27%
- Germany: 15%

Employees per region (2016, in %)

- Asia/Pacific: 18%
- Latin America: 9%
- North America: 9%
- EMEA (without Germany): 19%
- Germany: 45%
LANXESS with new strategic focus: Building a more balanced company

LANXESS AG

Advanced Intermediates  Performance Chemicals  Engineering Materials  Specialty Additives

More resilient  Strong cash generation  Solid platform for growth

*ARLANXEO to be fully consolidated by LANXESS for the first three years
LANXESS Distribution GmbH
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# LANXESS Distribution Markets

<table>
<thead>
<tr>
<th>Industrial Markets</th>
<th>Personal Care / F&amp;F</th>
<th>Speciality Markets</th>
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</thead>
<tbody>
<tr>
<td>Rubber</td>
<td>Personal Care</td>
<td>Fuel Additives</td>
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<tr>
<td>Construction</td>
<td></td>
<td>Heat Transfer Fluids</td>
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<tr>
<td>Coatings</td>
<td>Flavour &amp; Fragrances (F&amp;F)</td>
<td>Animal Nutrition</td>
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<tr>
<td>Water Sector</td>
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<tr>
<td>Metal treatment</td>
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<td>Synthesis Chemicals</td>
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**LANXESS Heat Transfer Fluids, Leverkusen 2017**
LANXESS Heat Transfer Fluids
Portfolio

**Diphyl® THT**
HTF for high temperatures, application in liquid phase

**Diphyl® KT**
HTF for low to high temperatures, pressure (less) application in liquid phase

**Diphyl® DT**
HTF for low to medium temperatures, pressure (less) application in liquid phase

**Diphyl®**
HTF for very high temperatures, pressure (less) application in liquid/vapour phase
DPO and DP: Tailor made products
Alkylated aromatics often arise as co-products

<table>
<thead>
<tr>
<th>HTF Components</th>
<th>Chemical Structure</th>
<th>Main Process</th>
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<tbody>
<tr>
<td>Aromatics</td>
<td></td>
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<tr>
<td></td>
<td>Diphenyl oxide (DPO)</td>
<td>Dedicated manufacturing processes</td>
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<tr>
<td></td>
<td>Diphenyl (DP)</td>
<td>Dedicated manufacturing processes</td>
</tr>
<tr>
<td>Alkylated Aromatics (examples)</td>
<td>Ditolylether</td>
<td>Cresol process</td>
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<tr>
<td></td>
<td>Hydrogenated Terphenyl incl. o/m isomers</td>
<td>Diphenyl process + Hydrogenation</td>
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<tr>
<td></td>
<td>Monobenzyl toluene</td>
<td>Ethylbenzene process (Styrene–Polystyrene production)</td>
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<tr>
<td></td>
<td>Dibenzyl toluene</td>
<td>Cumene process (Phenol production)</td>
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</table>
## LANXESS Heat Transfer Fluids
### Major Applications

<table>
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<tr>
<th>Polymers</th>
<th>Chemicals</th>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyesters (e.g. PET, PBT)</td>
<td>Sodium monobenzothiazole</td>
<td>Textile finishing</td>
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<tr>
<td>Polyester resins</td>
<td>Aniline</td>
<td>MSA production</td>
</tr>
<tr>
<td>ABS</td>
<td>Benzene refining</td>
<td>Phthalic anhydride melting</td>
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<tr>
<td>Polyamide 6/66</td>
<td>Chlorinated hydrocarbons</td>
<td>Heavy oil operations</td>
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<tr>
<td>Polyethylene/Polypropylene</td>
<td>Fatty acid esters</td>
<td>High octane distillation</td>
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<tr>
<td>Polystyrene</td>
<td>Silicones</td>
<td>Anthracene distillation</td>
</tr>
<tr>
<td>Thermoplastic rubber</td>
<td>Organic pigments</td>
<td>TDI condensation</td>
</tr>
<tr>
<td>Lacquers</td>
<td>Vinyl chloride/acetate</td>
<td>Nuclear reactor cooling</td>
</tr>
<tr>
<td>Oil varnish</td>
<td>Dioctyl/butyl phthalate</td>
<td>Solartherm* / E-energy</td>
</tr>
</tbody>
</table>

* Concentrated Solar Power is a major application which is explained in detail in a separate presentation.
LANXESS Heat Transfer Fluids
Experience & Knowledge

- Bayer patented Diphyl (DP / DPO eutectic) in 1929
- German technology & production facilities
- Comprehensive knowledge on the technical design of such installations
- Worldwide network of customers and research companies (> 200 plants)
- Development of standards/methods for HTF jointly with external institutes
- Experience within CSP projects for more than 10 years (initial filling & top up)
- Cooperation in CSP with engineering companies and DLR*
- High-tech laboratories and test facilities for HTF analytics (Currenta)
- Cooperation with leading contractors and plant construction companies
- Worldwide contacts to pharmaceutical, chemical & polymer industries

* Deutsches Zentrum für Luft- und Raumfahrt / National aeronautics & space research centre
LANXESS Heat Transfer Fluids
Comparison of synthetic HTF with identical composition

Please contact LANXESS for detailed information.
LANXESS Heat Transfer Fluids
Comparison of low cost synthetic HTF (alternatives for mineral oil)

Please contact LANXESS for detailed information.
LANXESS Heat Transfer Fluids
Safety

- To date, there are no harmful effects resulting from the use of Diphyl® as HTF
- Detailed guidelines and information are included in the corresponding safety data sheets
- These data sheets include detailed information on:
  - The chemical properties of the Diphyl® HTF, toxicological and ecological aspects
  - Physical and safety-related properties, e.g. flash point and autoignition temperature
  - Transport
  - Technical and personal protective measures
  - Storage and handling
  - Procedures in the event of accidents
LANXESS Heat Transfer Fluids
Pre and After Sales Activities

Technical support

- Experienced LANXESS experts offer worldwide technical support
- Worldwide network of plant engineering companies, subcontractors and research companies
- Support during selection of suitable Heat Transfer Fluid for initial filling
- Calculations regarding plant configuration are provided by LXS
- Technical support & advice after initial filling
- Support for analytical testing
LANXESS Heat Transfer Fluids
Pre and After Sales Activities

Commercial support

- Large storage capacities in Europe and Asia
- Short term deliveries
- Selection of packaging (drums, IBCs, ISO Tanks)
- Delivery in heatable ISO Tanks > 40°C
- Extensive Know How for demanding logistic solutions (CSP projects)
- Strong logistic network (flexible, delivery time & volume), experienced in CSP projects
- Sustainable solutions are offered (regeneration of used HTF on global basis)
# LANXESS Heat Transfer Fluids

## Marketing Activities

### Exhibitions
- CSP Conference, Beijing  
  23-24.03.2017
- WTS Seminar, Wiesloch  
  26-27.04.2017
- Menasol, Dubai  
  25-26.04.2017
- Khimia, Moscow  
  23-26.10.2017
- CSP Conference, Sevilla  
  November.2017

### Marketing Activities
- Industry-specific articles
- Brochures
- Customer Workshops
  
  - WWW.DIPHYL.COM
  
LANXESS Heat Transfer Fluids
Corporate Responsibility

Integration of Corporate Responsibility in the overall LANXESS strategy

- Signatory to the U.N. Global Compact
- Climate A List
- Member of FTSE4Good
- 9001 & 14001: Global matrix certificate
- Signatory of the Responsible Care® Global Charter
- Member of the Dow Jones Sustainability Index (World)

Joint initiative of international chemical companies for sustainable supply chains in the chemicals industry*

- Improving the sustainability and transparency supply chain
- Monitoring compliance with the “Supplier Code of Conduct”
- Sustainability assessment and joint audits

* Members include: Akzo Nobel, Arkema, BASF, Bayer, Clariant, Covestro, DSM, Eastman, Evonik, Henkel, IFF, LANXESS, Merck, Solvay, Syngenta, Wacker.
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