



**QUALITY WORKS.**

# **LANXESS Heat Transfer Fluids for Concentrated Solar Power Plants (CSP)**

Dr. Wolfgang Podestà & Mercedes Bayer

Leverkusen, 2017

**LANXESS**  
Energizing Chemistry

# LANXESS

## A globally operating specialty chemicals company

**LANXESS**  
Energizing Chemistry



### Specialty chemicals company

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



### Global success story

- 54 sites worldwide
- Approximately 16,700 employees in 25 countries
- Global sales of € 7.7 billion in 2016



### Strategy of profitability and resilience

- Enhancing its leading position in mid-sized markets

# LANXESS Distribution GmbH

## Your Contact



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# LANXESS Heat Transfer Fluids

## Experience & Knowledge

### Experience & Know How

- BAYER patented **Diphyl®** (DP / DPO eutectic in 1929)
- German technology
- Development of standard test methods for HTFs
- LANXESS handles HTFs in >200 production plants worldwide
- More than 10 years experience with CSP plants (initial/top-up)

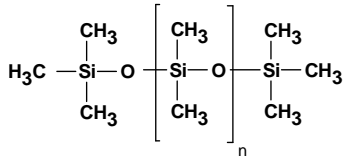
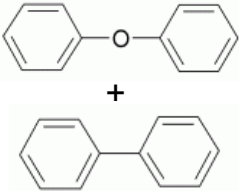
### Cooperations

- Cooperation in CSP with leading engineering companies and research centers (DLR)\*
- LANXESS has partnership with leading contractors & plant construction companies
- Service partner CURRENTA with high-tech analytical laboratories and test facilities for HTFs

\* DLR (Deutsches Zentrum für Luft- und Raumfahrt/ National aeronautics & space research centre of Germany)

# LANXESS Heat Transfer Fluids

## DPO/DP (Diphyl<sup>®</sup>) – Preferred for Parabolic Trough CSP

HTF components	Chemical structure / basic products	Application Range
Silicones	 <p>Modified polydimethylsiloxane</p>	<p>-40 to +430°C Not yet approved, no long-term experience</p>
Aromatics	 <p><b>Diphenyl oxide (DPO)</b></p> <p><b>Diphenyl (DP)</b></p>	<p><b>+12 to +400°C</b> <b>approved standard for PT</b></p>
Salt melts	<p><math>\text{KNO}_3 - \text{NaNO}_3</math></p> <p>Potassium/sodium nitrate</p>	<p>+230 to +550°C approved standard for solar towers, not approved for PT</p>

# LANXESS Heat Transfer Fluids

## German Technology Network

<b>LANXESS</b>	Manufacturer of high quality HTFs for many applications
<b>DIN (EN)</b>	Development and release of test methods
<b>DLR</b>	Institute for solar research
<b>FLAGSOL</b>	Developer and constructor of solar power plants since 40 years
<b>FRAUENHOFER</b>	Application oriented research
<b>TÜV RHEINLAND</b>	Testing, assessment & certification
<b>SIEMENS</b>	Plant constructor
<b>KRAFTANLAGEN GRUPPE</b>	Energy & power plant technology
<b>SCHOTT SOLAR</b> (now: RIOGLASS)	Solar thermal receiver technology
<b>HEAT11</b>	Heat transfer plant design and construction

# LANXESS Heat Transfer Fluids

## Diphyl® Thermal Stability Test

- When Heat Transfer Fluids (HTF) degrade, the amount of degradation increases dependent on the increase of temperature, length of exposure or both
- Degradation products include high and low boiling components, gaseous decomposition products, and products that cannot be evaporated
- Type and content of degradation products will change the performance characteristics of a HTF
- Tests according to DIN 51528 and ASTM D6743-11 performed by independent laboratories:
  - **DLR** (Deutsches Zentrum für Luft- und Raumfahrt/ National aeronautics & space research centre of Germany)
  - **CURRENTA GmbH & Co. OHG**
- Test results show that Diphyl®, Therminol VP-1 and Dowtherm A, containing the eutectic mixture of diphenyl and diphenyl oxide, have essentially the same physical properties and relative thermal stability.
- Diphyl® can thus be used for original filling and is fully suitable for the refill of equipment that carries originally Dowtherm A or Therminol VP-1

# LANXESS Heat Transfer Fluids

## Technical Analysis by DLR\*

Accelerated ageing of HTF fluids for CSP plants



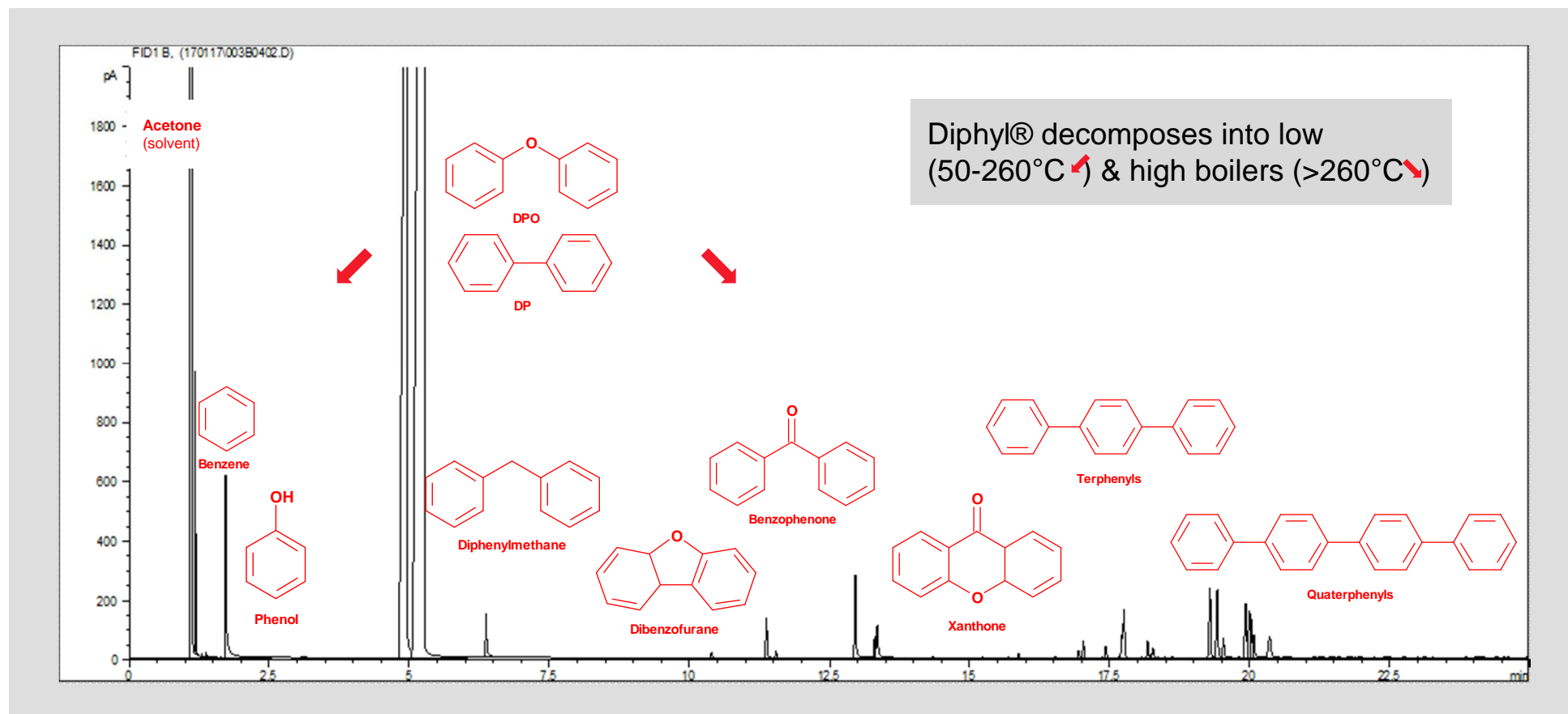
Fusing of degassed samples in glass ampoules  
Long term storage at 400 – 450°C for up to 1000 hrs.

\* DLR (Deutsches Zentrum für Luft- und Raumfahrt/ National aeronautics & space research centre of Germany)



# LANXESS Heat Transfer Fluids

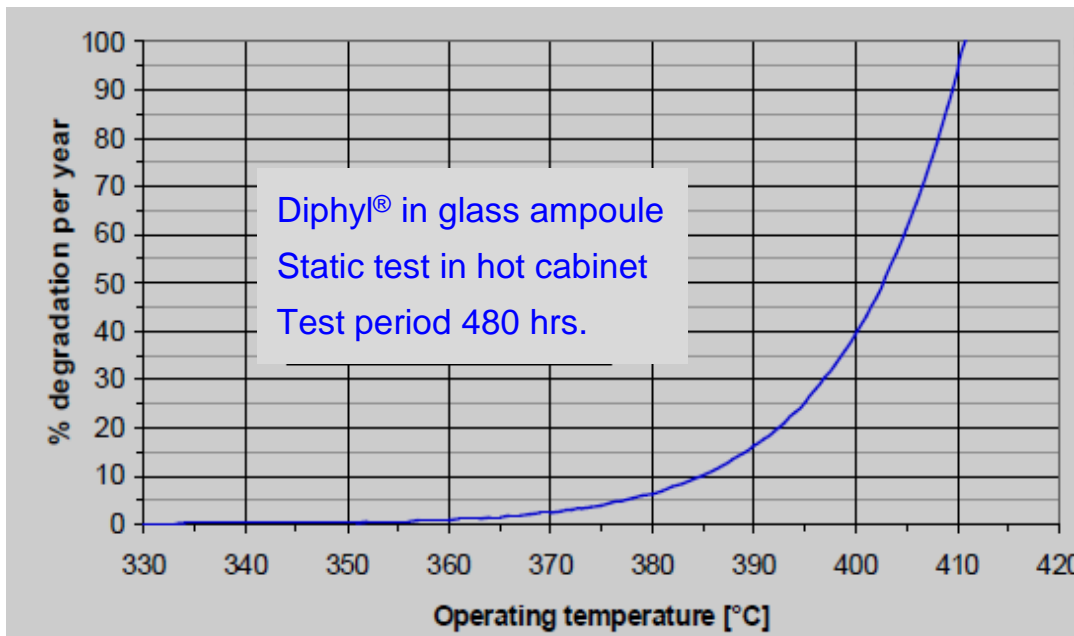
## Technical analysis – decomposition products of Diphyl<sup>®</sup> (GC)



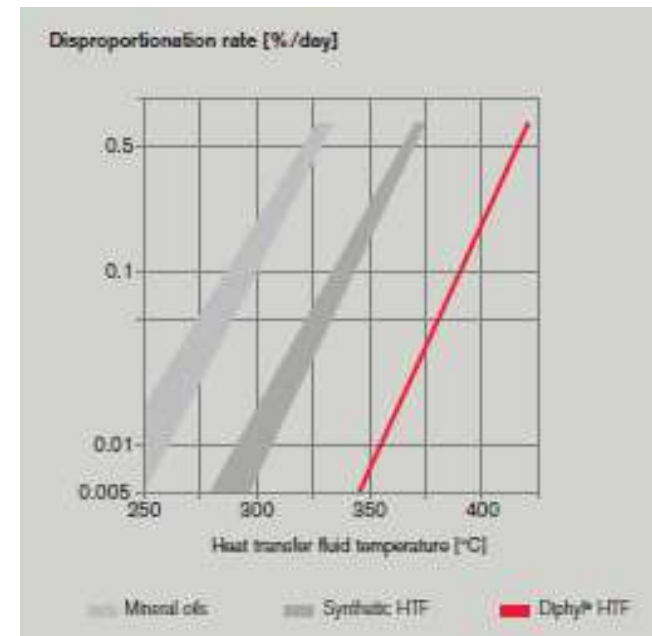
# LANXESS Heat Transfer Fluids

## Technical analysis – decomposition of Diphyl®

Degradation according to DIN 51528



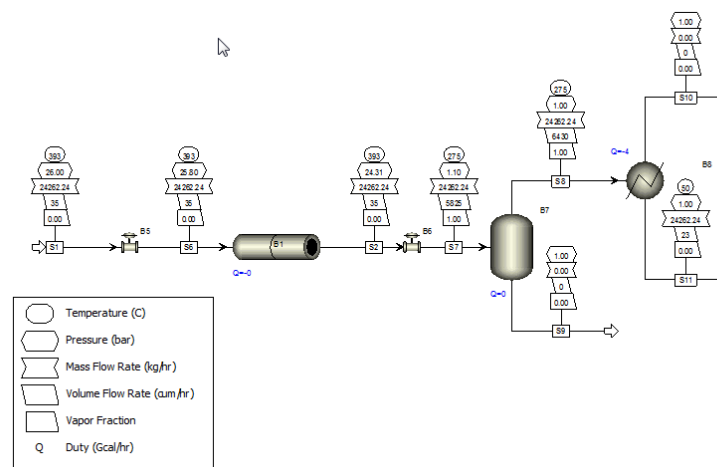
Decomposition in autoclave test



# LANXESS Heat Transfer Fluids

## Safety Analysis for DP/DPO use in CSP plants

- Exposure control / personal protection **Diphyl®**
- Safe handling and storage of **Diphyl®**
- Risk assessment safety precautions
- Environmental precautions
- Procedures in case of spillage
- Accidental release measures
- First aid measures
- Firefighting measures
- Disposal considerations



# LANXESS Heat Transfer Fluids

## References in CSP Business



### COMPANIES

STEAG

SOLEVAL

ABENGOA

SAMCA

IBERDOLA

ELECNOR

TORESOL

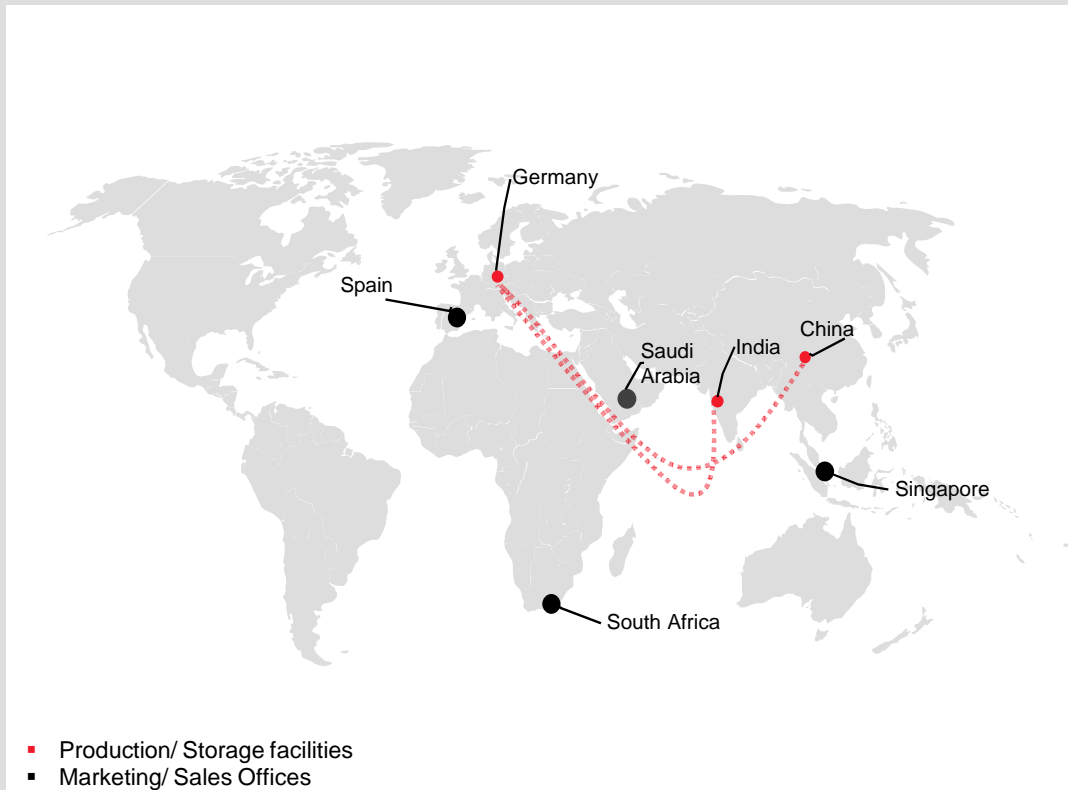
IBEROLICA

MARQUESADO SOLAR

NEXTERA

# LANXESS Heat Transfer Fluids

## Service for CSP



- Production sites in Germany, India and China
- Stock points
- Local contacts (agencies)
- Delivery in ISO tankers
- Qualified logistics partners
- Intermediate buffer stocks
- Delivery of heated containers
- Road transport to CSP
- Pre & after sales support
- Sustainable solutions
- Regeneration of used HTF

# LANXESS Heat Transfer Fluids

## Logistics / Supply Chain

### Equipment

- LANXESS cooperates with global logistics partners with own ISO tanker fleet
- ISO tankers must have highest technical and safety standards

### Logistics

- LANXESS uses stockpoints in Germany, India and China
- Development of logistics concept
- Offering intermodal network (road, rail, sea)
- Evaluation of storage terminal close to CSP plant
- Coordination monitoring of the supply chain

### Task force

- Heating operation
- Technically experienced contractor accompanies unloading process

# LANXESS Heat Transfer Fluids

## CSP Partners

LANXESS commands of a broad portfolio of references for initial filling and top up business worldwide.

For detailed information please contact:

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# LANXESS Heat Transfer Fluids

## Certificate of Comparability / Lanxess Quality Certificate



LANXESS Distribution GmbH

To whom it may concern

LANXESS DIPHYL  
- Statement of Compatibility

DIPHYL of LANXESS contains two chemical substances, that mixed under all aspects of quality assurance to achieve a so called eutecticum mixture of diphenylsulfide and diphenyl. From a physical standpoint essential properties of DIPHYL [density, dynamic viscosity, solidification point, boiling point, max. bulk temperature]\* can be expected to be similar to other products available in the market (e.g. Dowtherm A and Therminol VP1). To the best of our knowledge, DIPHYL is miscible, in other words, DIPHYL can act as a refilling agent in equipment, that carries originally either Dowtherm A or Therminol VP1. In that respect and also to the best of our knowledge, we do not expect an impact to any of these properties within the field of heat transfer fluid application.

You receive this information for your consideration and assessment in regard of your specific requirements; it shall neither be deemed to constitute a warranty of fitness for purpose, nor is it a "Guarantee" in the sense of Art. 444 of the German Civil Code (BGB).

\*Comparison of essential properties






July 08, 2016

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 	 <b>CERTIFICATE</b> I	
	This is to certify that  <b>LANXESS</b> LANXESS AG and affiliates <small>LANXESS Tower Königsplatz 1 50579 Köln / GERMANY</small> with the organizational units/sites as listed in the annex  has implemented and maintains a <b>Quality and Environmental Management System.</b>  Scope: Development, Production, Technical Applications & Solutions and Sales of Organic and Inorganic Basic and Special Chemicals within the following Units: Advanced Industrial Intermediates, AIL/ANZO, High Performance Materials, Inorganic Pigments, Leasing, Liquid Purification Technologies, Material Protection Products, Rhein Chemie Additives, Galigo and the Group Functions and Affiliates (Legal Entities).  Through an audit, documented in a report, it was verified that the management system fulfills the requirements of the following standards:  <b>ISO 9001 : 2008</b> <b>ISO 14001 : 2004 + Cor 1 : 2009</b>  Certificate registration no. 004312 QM08 UIM Date of revision 2016-09-06 Valid from 2015-09-04 Valid until 2018-09-14 Date of certification 2016-09-01   DQS GmbH  Frank Gräber Managing Director  Accredited Body: DQS GmbH, August-Scherer-Strasse 21, 69633 Frankfurt am Main, Germany	



# LANXESS Heat Transfer Fluids

## Concentrated Solar Power Industry

- **LANXESS is a well known partner in the CSP community**
- LANXESS has been operating for more than 10 years in the field of CSP supported by German engineer and research companies (Flagsol, DLR)
- LANXESS supplied **Diphyl®** for start-up CSP plant in Los Arenales / Spain and refill for several plants
- LANXESS is regularly involved in new CSP projects worldwide (new plants and top up of existing plants)
- LANXESS internally / externally analysed CSP market and technology development
- LANXESS is looking for further CSP projects worldwide
- LANXESS is on an equal footing with other suppliers and therefore

***THE RIGHT CHOICE***



**QUALITY HEATS.**

**LANXESS**

Energizing Chemistry

# Disclaimer

**Health and Safety Information:** Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets, product information and product labels. Consult your LANXESS representative in Germany or contact the Regulatory Affairs and Product Safety Department of LANXESS Deutschland GmbH or - for business in the USA - the LANXESS Product Safety and Regulatory Affairs Department in Pittsburgh, PA, USA.

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