Polymeric Materials for Solar Thermal Applications

(2006-2014)

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Subtask Leader C

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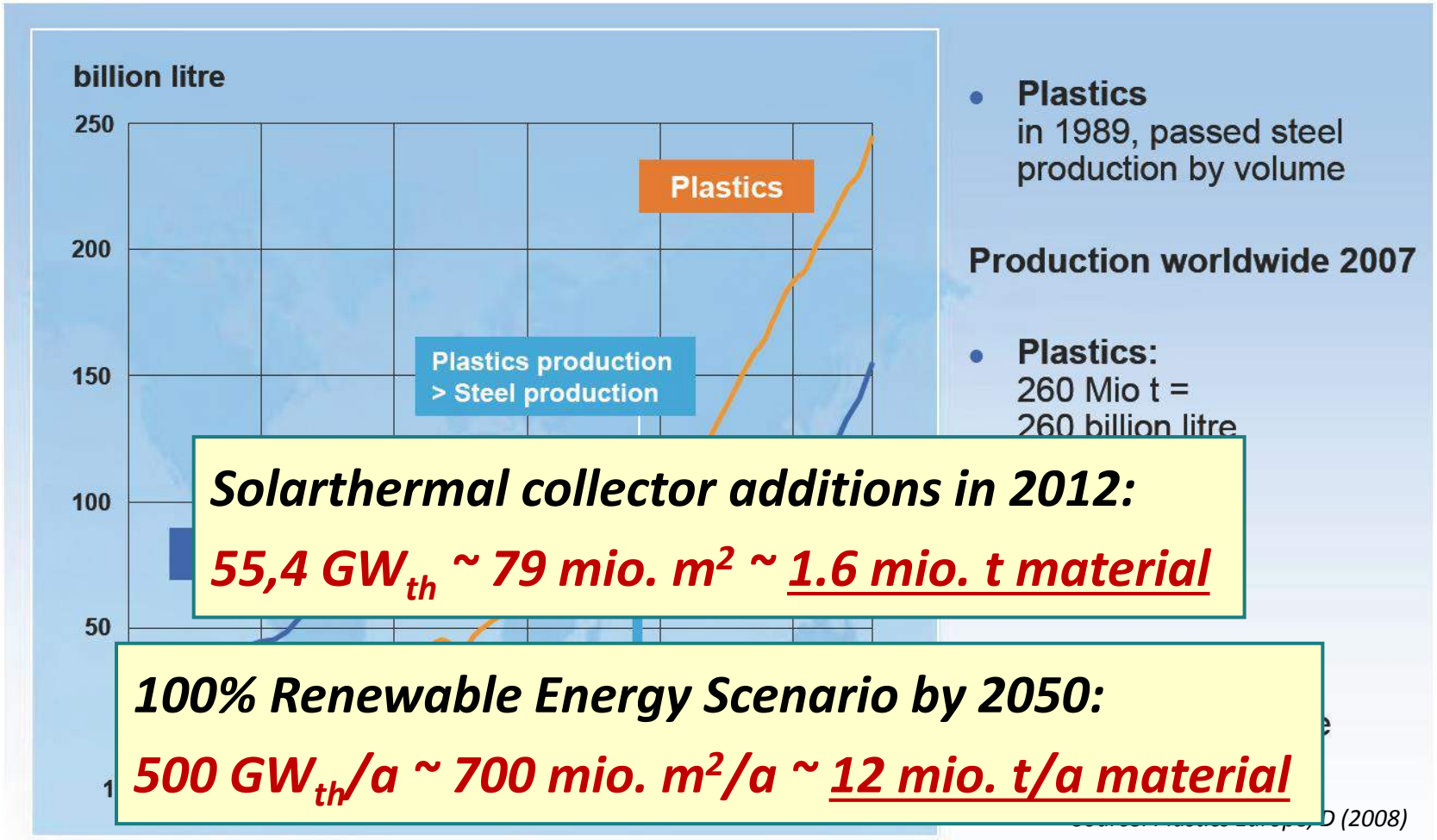
The importance of the polymer industry

Development of plastics and steel worldwide (in terms of volume)



Objectives and associated projects

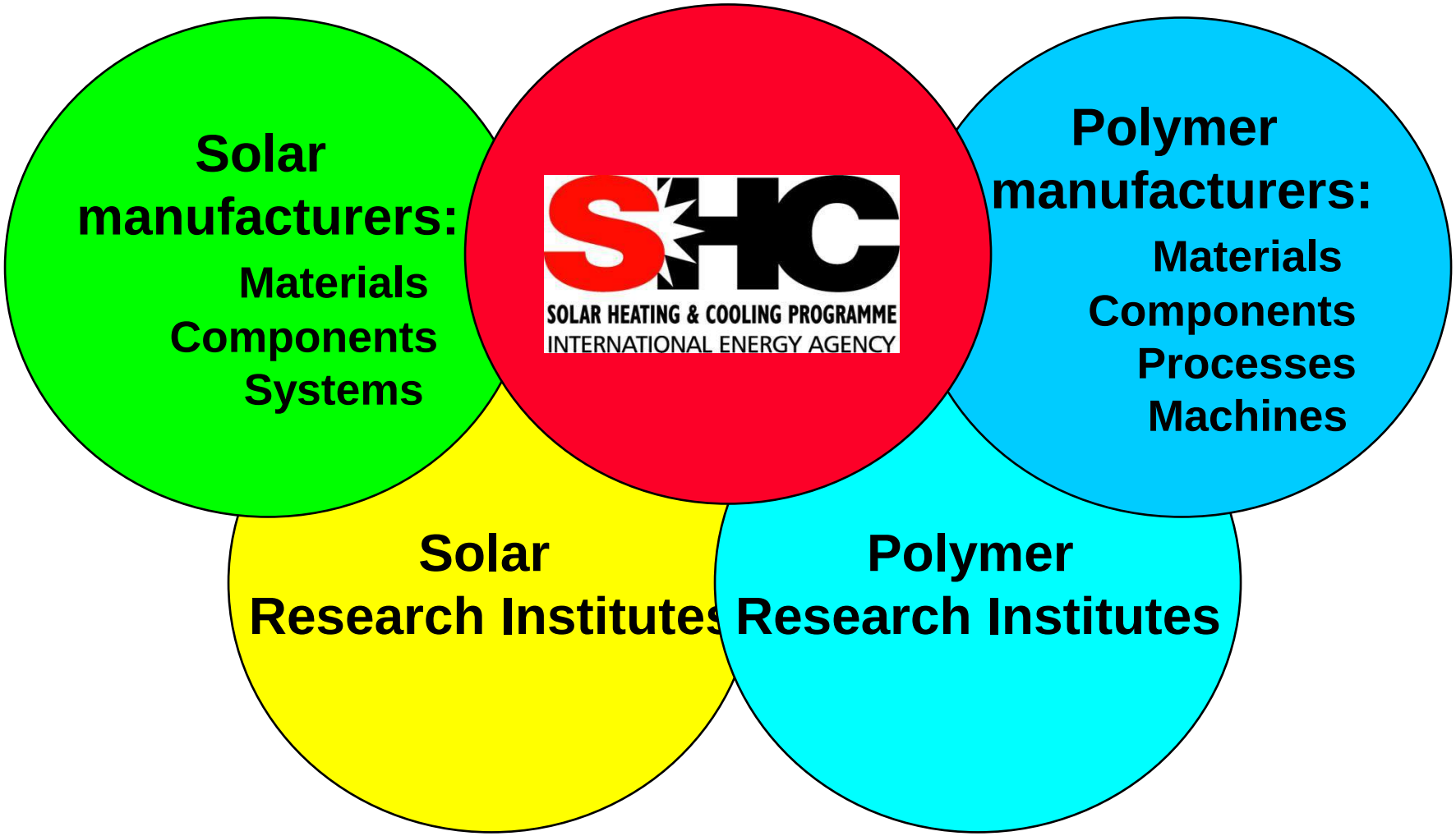
Objectives

- Assessment of the **applicability of polymeric materials** for solar thermal collectors and systems
- Novel polymer based **designs and components**
- Assessment of **durability** and **reliability**
- Promote increased **confidence** in the use of these products
- Development and application of appropriate **testing and certification methods**

Associated projects in Austrian participation

- Phase 1 (06-10): Basic research projects
- Phase 2 (10-14): Industrial collaborative research projects
  - ***SolPol-1/2* – KLI:EN / FFG**
  - **SCOOP – EC FP7**

Task 39 - Stakeholders



Task 39 – Subtask division

SUBTASK A

- **Information**
  Dr. Michaela Meir, **Norway**

SUBTASK B

- **Collectors**
  Dr. Stephan Fischer, **Germany**

SUBTASK C

- **Materials**
  Prof. Dr. Gernot Wallner, **Austria**

OPERATING AGENT: Dr. Michael Köhl, FhG ISE, **Germany**

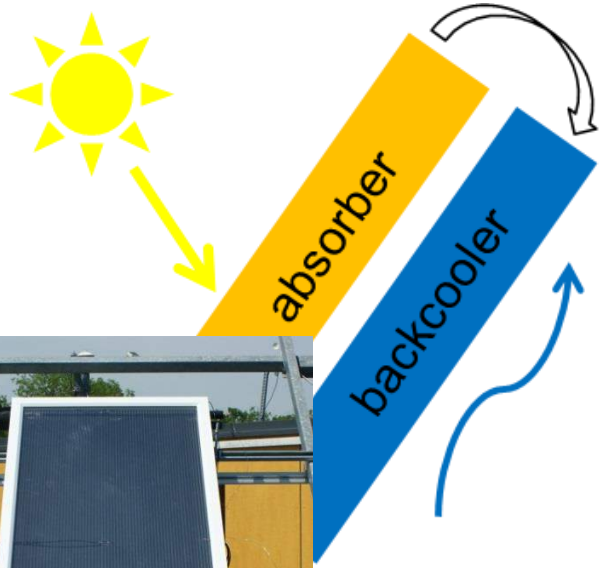
Partners of Subtask C on Materials

10 Countries	13 Company partners	10 Scientific partners
Austria, Belgium, Brasil, Germany, Netherlands, Norway, Portugal, Slovenia, Switzerland, USA	BOREALIS SHAPING the FUTURE with PLASTICS; SOLVAY; sabic; EMS EMS-GRIVORY; BASF The Chemical Company; Chevron Phillips Chemical Company LP; DUPONT; DS Smith; agru Worldwide Competence in Plastics; APC advanced polymer compounds; BBT THERMOTECHNIK; Roth; fsave; Color	JKU Johannes Kepler Universität Linz; AIT; PCCL; Fraunhofer ISE; Fachhochschule Osnabrück University of Applied Sciences; SPF; UiO : Department of Physics University of Oslo; Solar Energy Laboratory

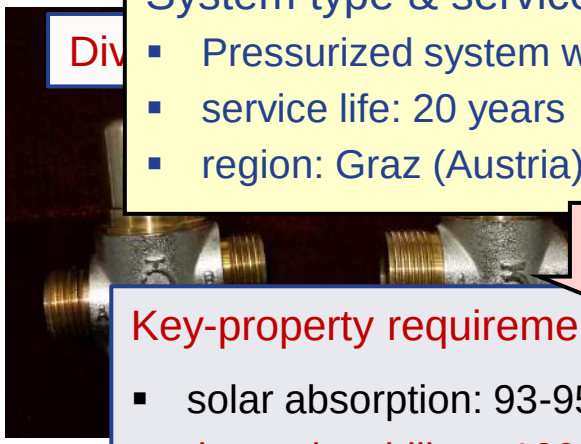
Overheating controlled collectors

Absorber materials for overheating protected collectors
(Borealis, Univ. of Linz, AEE INTEC, Univ. of Innsbruck (Austria))

Overheating control by backcooling



Max. absorber temperature in stagnation: ~ 92°C



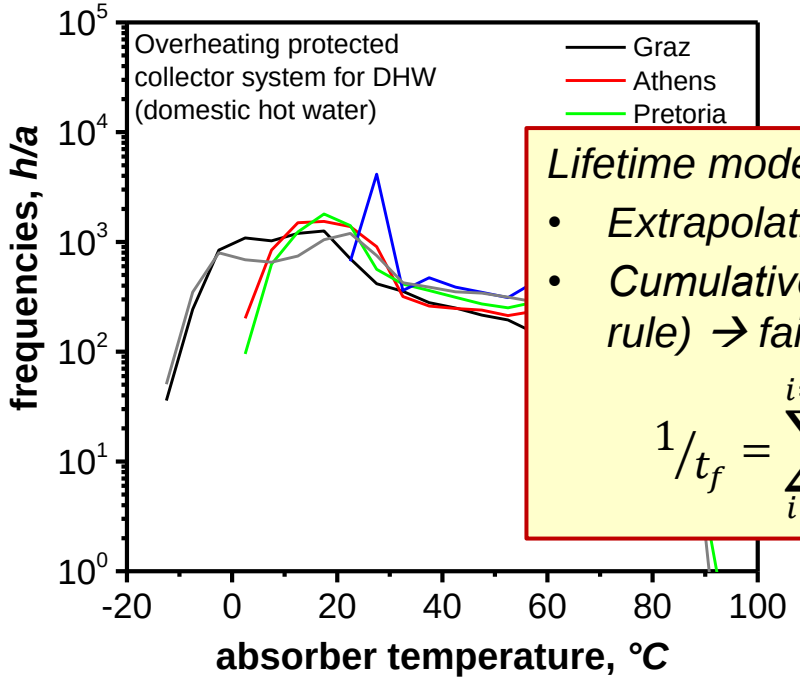
System type & service requirements
- Pressurized system with overheating protection
- service life: 20 years
- region: Graz (Austria)

Key-property requirements for *absorber materials*
- solar absorption: 93-95%
- thermal stability: >100°C
- low temperature capability: -30°C
- long-term stability in water/glycol:
  - 75-100°C: > 3,500 h (DHW)
    > 7,000 h (SH)
  - 0-75°C: > 150,000 h
- pressure: max. 1,5 bar

Overheating controlled collectors

Development and lifetime estimation for PP absorber materials

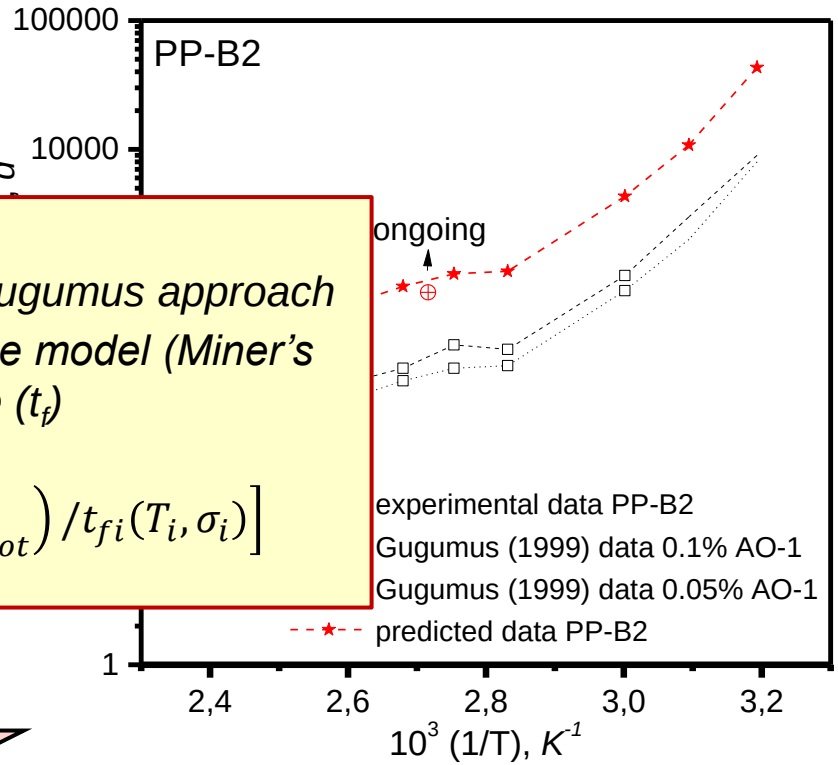
(JKU IPMT; AEE INTEC, Austria)



Lifetime modelling:

- *Extrapolation by Gugumus approach*
- *Cumulative damage model (Miner's rule) → failure time (t_f)*

$$1/t_f = \sum_{i=1}^{i=n} \left[\left(t_i / t_{tot} \right) / t_{fi}(T_i, \sigma_i) \right]$$



Lifetime, years	Graz, AT	Athens, GR	Pretoria, RSA	Fortaleza, BR	Beijing, CHN
PP-B1	21	15	14	8	23
PP-B2	32	25	24	15	34

Overheating controlled collectors

Development and lifetime estimation for PP absorber materials

(Univ. Linz, Borealis, AEE INTEC (Austria))

Novel material PP-B2 is now used commercially!

MAGEN eco-ENERGY
(Israel, Kibbuz Magen)

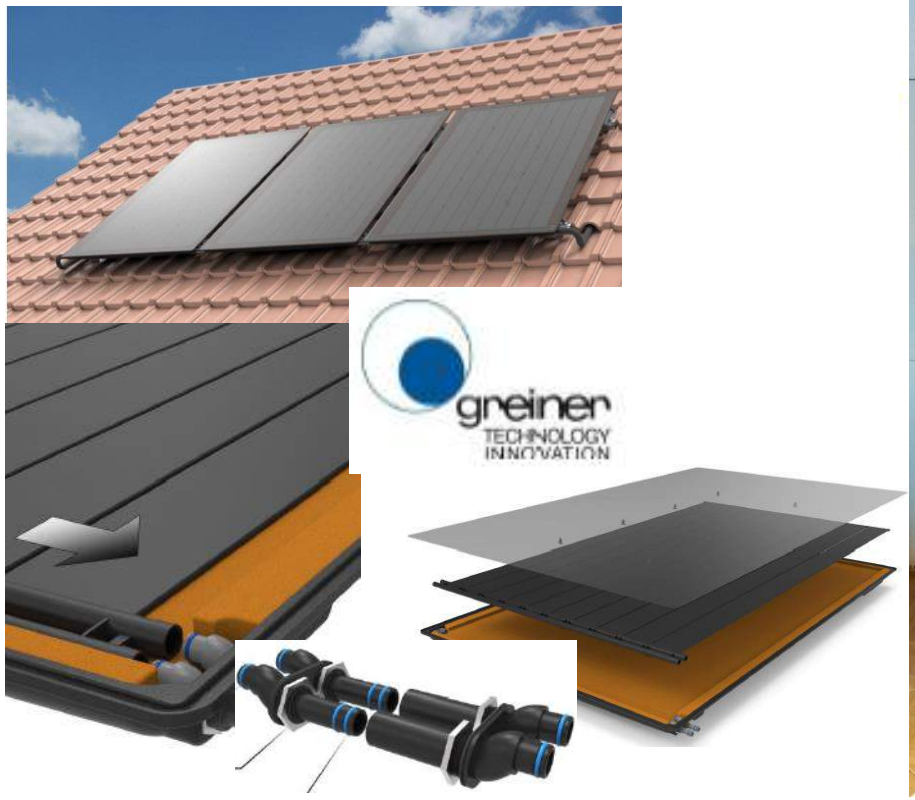
www.magen-ecoenergy.com

Lifetime, years					Beijing, CHN
PP-B1					23
PP-B2	**32**	**25**	**24**	**15**	**34**

Overheating controlled collectors

All-polymeric collectors developed in Austria
(Sunlumo, GTI)

Greiner Technology & Innovation GmbH *(GTI, Kremsmünster/A)*



Sunlumo Technology GmbH *(Perg/A)*
"One World Collector"

Solar Keymark obtained in Oct 15

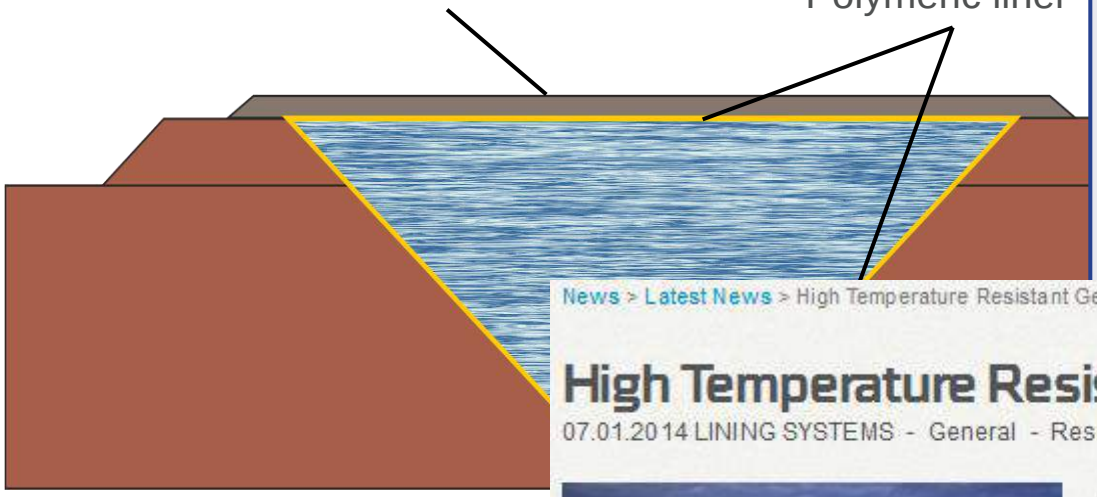
Heat storage liner materials

Liner materials for seasonal hot water storages
(AGRU, Univ. of Linz (Austria))

Example
SUNSTORE4, Marstal, DK (75 000 m³ water)

Floating insulating cover

Polymeric liner



Liner material development

Criteria … *…ials:*

- Flex… …on:
  - –
  - – …m
- Key…
  - – T…
  - – 4,…

News > Latest News > High Temperature Resistant Geomembrane

High Temperature Resistant Geomembrane

07.01.2014 LINING SYSTEMS - General - Research

agru Worldwide Competence in Plastics

AGRU for many years has supplied PE pipes for hot water applications. With this vast knowledge and experience AGRU developed the first high temperature resistant (HTR) PE geomembrane in the marketplace. It looks, feels and welds like every other HD-PE geomembrane. Additionally it offers an outstanding

Dimensions:

- …
- *Demand of liner:*

Spin-off:

Meetings and Workshops / in Austria

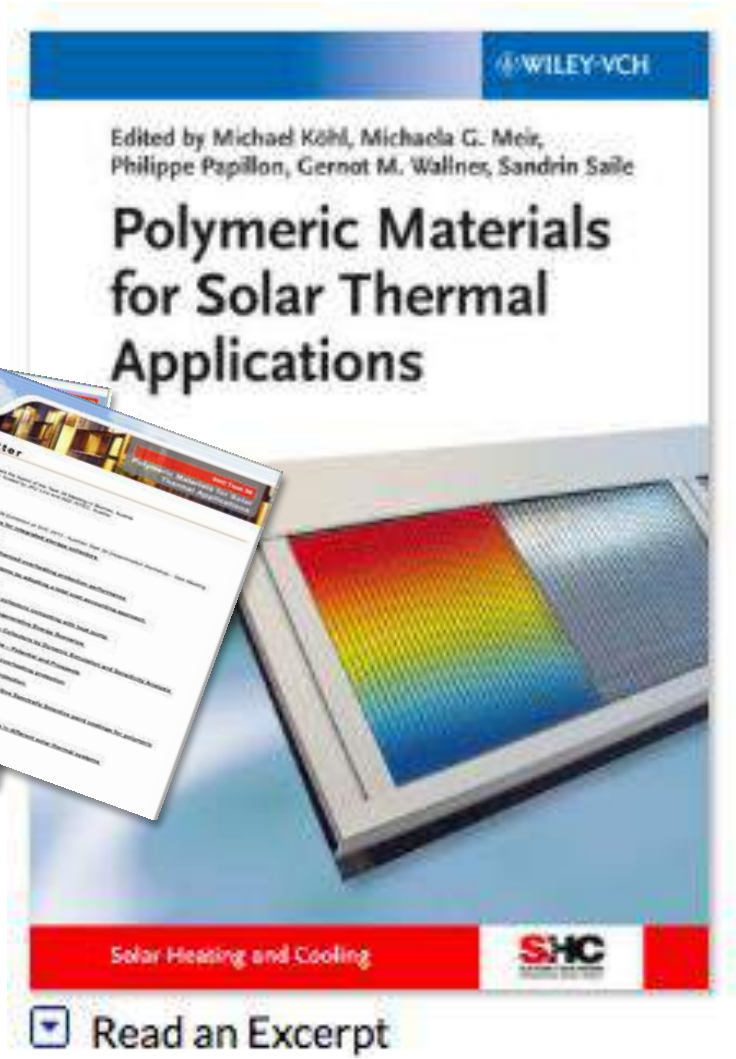
- 20 Experts Meetings in GER, AUT, CH, SLO, NOR, POR, FR, ESP, ISR, USA
  - 5 Experts Meetings in Austria (06, 07, 10, 13)

- 7 Industry Dissemination Workshops (3 in Austria in 08, 11, 13)

Publications

- IEA SHC Task 39 Handbook (Köhl et al., 2012)
- 14 Newsletters and 35 Info sheets

- IEA and national reports



Summary and outlook

Summary

- **Polymeric Materials** allow for **significant advances** of **solar thermal technologies**, especially for **hot water preparation** and **space heating**
- Reliable **components** have been **developed** and **introduced in the market**
- **Tools** for **material selection**, **product design** and **lifetime testing** were established
- **Austria strengthened and expanded** its **leading position**

Market trend and needs

- **Stagnation** or even decay of **solar thermal market** (especially **in Europe**)
- Significant **cost reductions on system level** are required (> 50%)

Outlook

TASK 54

- Implementation of **IEA SHC Task 54** "**Price reduction** of solar thermal systems"
- **Industrial research project *SolPol-4/5*** "Novel Pumped and Non-Pumped Collector Systems" (KLI:EN / FFG)

solpol