Demonstration of Polymeric Collectors

In the final phase of the project SCOOP's novel design developments are installed in various demonstration projects in Norway. This newsletter contains the first pictures of the polymeric collector systems that will be realized in 2014. Further topics are:

- Progress on injection molded components of an all polymeric integrated collector storage (p. 1)
- Luminescence spectroscopy for non-destructive characterization of polymers (p. 2)
- Optimization of DHW preparation for polymeric thermosiphon systems (p. 3)

The past project meeting was held in conjunction with the Gleisdorf Solar Conference 2014 in Gleisdorf, Austria on 24 - 25 June 2014. The next meeting will be hosted by the University of Oslo, Oslo, Norway in October 2014.

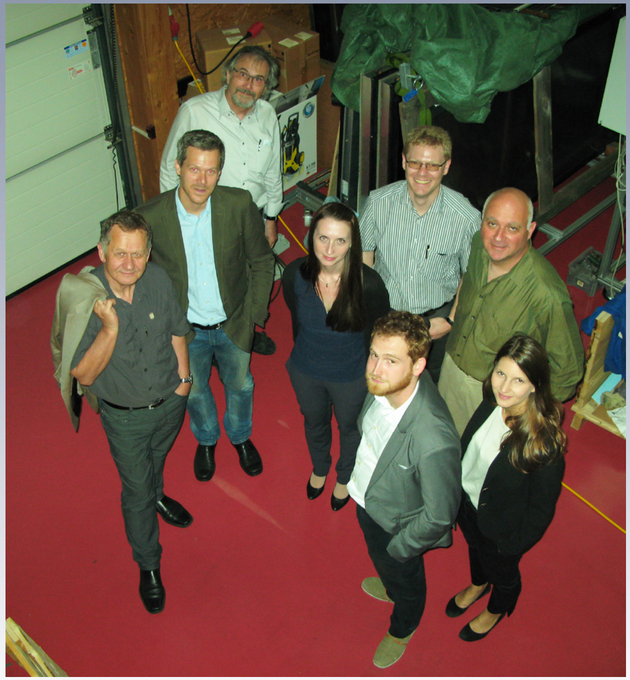

Fig. 1 – 3: Project meeting in Gleisdorf, Austria, June 2014.

Injection molded storage collectors show high potential

One of the overall objectives of the project is the systematic evaluation of the opportunities and limitations of injection molding technologies for the production of integrated storage collectors. Polymeric material grades and appropriate manufacturing technologies are developed and both evaluated.

Glass fiber reinforced plastics were compounded

A variety of glass-fiber reinforced engineering plastics were compounded and characterized on specimen level for the optimization of the temperature and pressure resistant absorber/ storage container.

Their long-term behavior was also considered. The most promising material candidates proved to be polyamide grades with a glass-fiber content of 30 m%. Pressure cooker tests at elevated temperatures (95 to 135°C) reveal a good durability under service relevant conditions. Further research focuses on the lifetime assessment for the investigated grades.

For further information about the project:

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In order to obtain functional model absorbers (Fig. 4), half-shell parts were injection molded and assembled. An optimum wall thickness of the absorber/storage container of 2 mm was deduced. Frictional welding was identified as the most durable and practical joining technique. The plastics based functional model absorbers showed a remarkable performance. In the further work special emphasis will be placed on the investigation of the long-term behavior on component level.

Fig. 4: : Model absorber based on welded injection moulded half-shell parts for inspection.

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Luminescence spectroscopy for non-destructive characterization of polymers

Significant progress has been made at HUB with respect to the characterization of polymer ageing by luminescence spectroscopy. Complete UV/VIS excitation-emission spectra of polymer luminescence were acquired for different ageing conditions at different ageing times.

Figure 5 shows representative excitation-emission contour plots of luminescence for a polyamide grade aged at 115°C dry heat for 25h and 1500h. It is visible that not only the luminescence intensity significantly increases with ageing time but also specific peak positions appear/disappear or shift to longer wavelengths. These changes in luminescence are already detectable after 25h of ageing whereas other ageing indicators lack sensitivity.

By analyzing this data in more detail polymer-specific excitation and emission wavelengths can be selected to characterize polymer ageing (oxidation) by single point measurements with, e.g. mobile systems or online within the production process.

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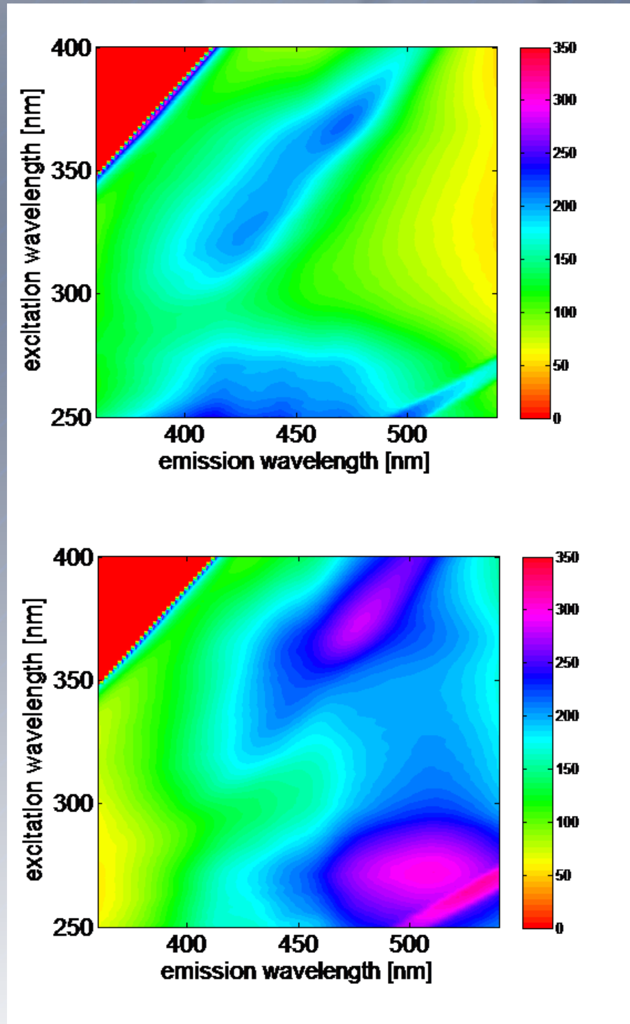

Fig. 5–6: Luminescence excitation-emission contour plot of a polyamide grade aged at 115 °C dry heat for 25h (top) and 1500h (bottom).

Optimization of DHW preparation for polymeric thermosiphon systems

The thermosiphon system (TSS) under development in SCOOP is based on extruded polymeric structured sheets and designed as direct and indirect system.

Water is extracted through a heated exchanger

In the indirect version the solar energy is extracted through a heat exchanger from the TSS storage tank for domestic use. In the past months the focus was placed on finding the optimal heat exchanger material and design for best performance and lowest costs in a polymeric TSS. As heat exchanger materials, plastics and stainless steel were investigated for different designs and wall thicknesses. Laboratory tests were performed comparing prototypes of stainless steel tank-in tank and spiral heat exchanger designs. CFD simulations by the SCOOP partner HTCO proved to be very useful in simulating the heat exchanger's in- and outtake connections for different volume flow rates.

Based on these findings three modifications of tank heat exchangers were constructed and various characteristics of the corresponding TSS are tested at the outdoor test sites of AEE INTEC (Austria) and Aventa/UiO (Norway); further studies at SPF (Switzerland) are currently under preparation.

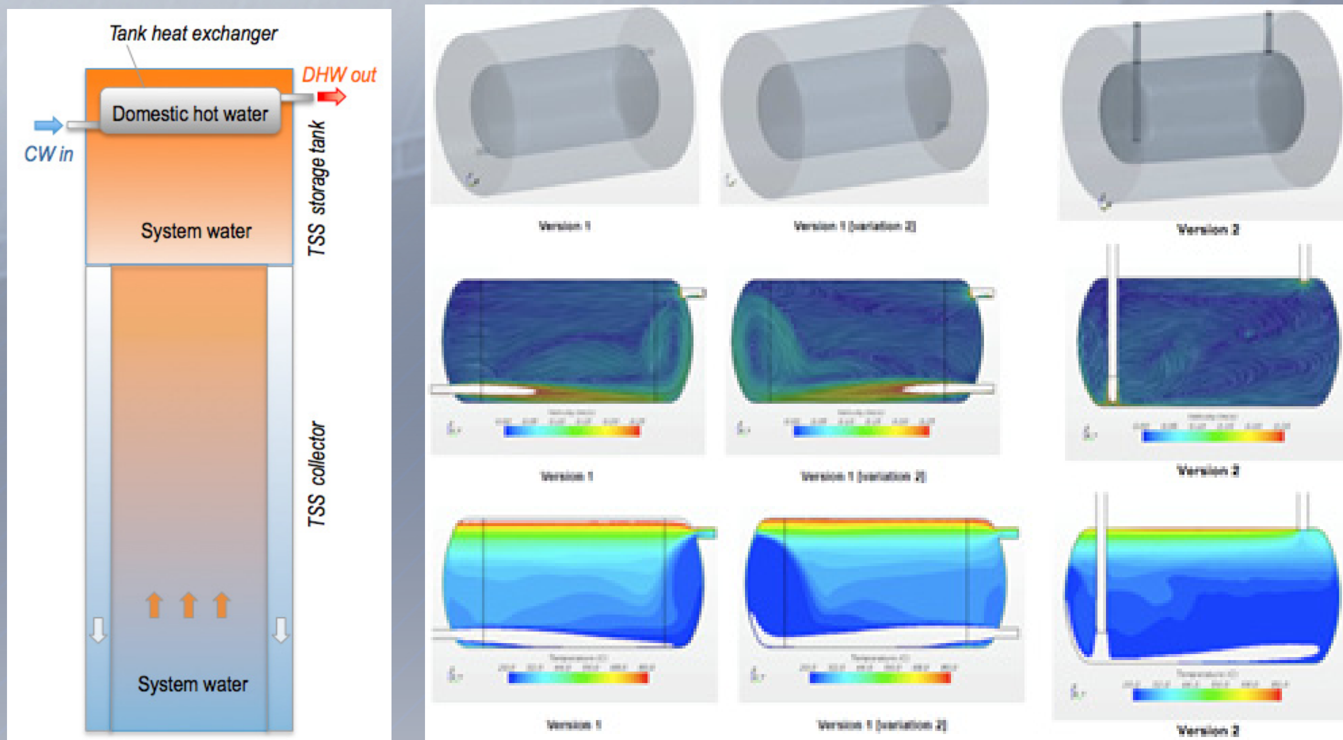

Fig. 7–8: Performance study of TSS heat exchanger modifications by CFD simulations.

For further information

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Demonstration projects are progressing

Several projects of building integrated collectors, integrated collector storage (ICS) and thermosiphon systems (TSS) of polymeric materials are currently installed or as prototypes in the testing phase and available for demonstration.

Prototypes are presented

The four examples presented in figure 9 – 11 are prototypes of polymeric integrated ICS and TSS set up at AEE INTEC's site for comparative testing (A, B).

Further, a demonstration of roof-integrated polymeric collectors in passive houses, a project built by the largest Nordic housing association OBOS in Oslo, will be constructed until autumn 2014 (A). The fourth example is the demonstration of polymeric solar absorbers in glass facade modules in Stavern (Norway), a collaboration between the collector manufacturer Aventa and one of the largest Nordic window producers NorDan (B).

Interested in a collaboration?

Are you a distributor, project planner or investor of solar thermal systems and interested in a new polymeric thermosyphon concept?

Get in touch with Aventa!

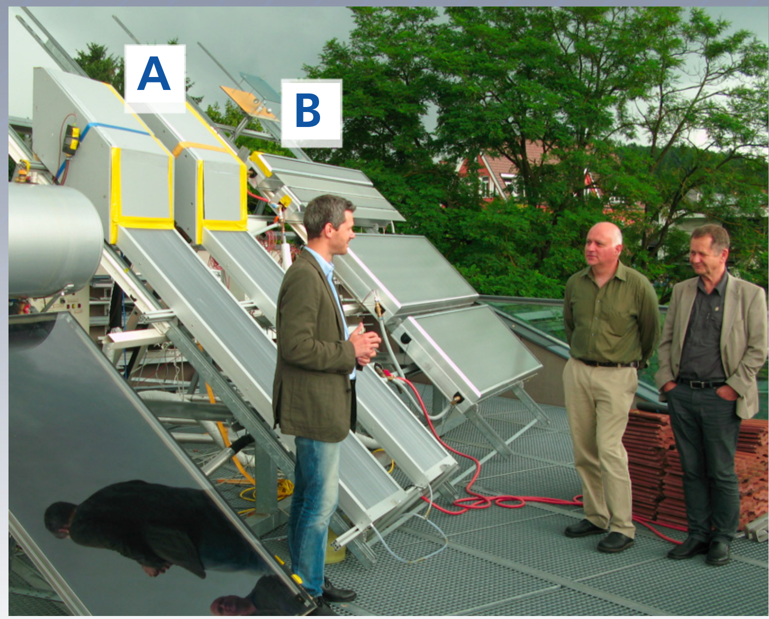

Fig. 9: Visit of AEE INTEC's test site during the last SCOOP project meeting in Gleisdorf in June 2014.

Fig. 10: SCOOP demonstration projects: C) Roof-integrated solar collectors (Oslo, Norway) and D) polymeric absorbers integrated on glass facade modules (Stavern, Norway).

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