All polymeric collector Sunlumo

INFO Sheet B15

Description:	*Developing plastic-based solar collectors for the volume market*
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Solar collector panels for the volume market

Recent estimates have shown a steadily rising need for solar collector panels worldwide, from 10 to 15 percent annually. By 2020 the annual demand for collector surface is thought to be around 200 to 400 million square meters. This demand will be met with great difficulty only, if at all, when relying on conventional aluminum or copper panels. Materials for traditional collector panels are scarce and, therefore, too expensive to produce or sell collectors as an affordable mass product. Sunlumo's R&D is geared to bridge this gap between the two poles – of a sufficient raw material supply on the one hand and of low prices for the volume market on the other. Their R&D is thus focused on innovative technologies, new materials such as polymers, and manufacturing options for the mass market.

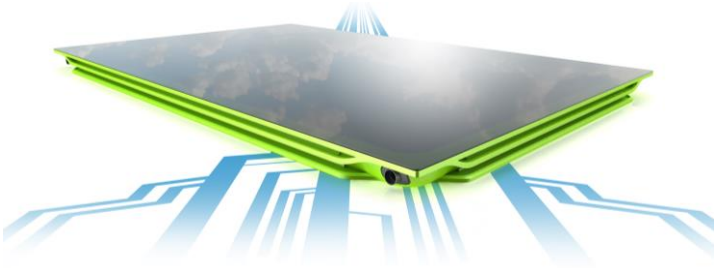

Figure 1: One World Solar Collector (Sketch from Sunlumo)

Quality factors in developing solar collectors

Adapting manufacturing processes for serial production in great numbers is one of the major challenges in developing plastic-based solar collectors. It requires top-quality components that meet even the highest standards. This means defining the loads acting on each of the collector components and adapting the design of components accordingly. The resulting knowledge is then used for a detailed component design. The design of joints and the materials used in their fabrication have to be tested and optimized. Process simulations, such as injection moulding simulations, are carried out in order to check the suitability for serial production of components and the relevant manufacturing processes; in addition, parameter ranges for the manufacturing processes and the design of tools must be defined. In the run-up, expensive procedures will serve to determine the parameters for the plastic to be used in the simulations.

The tests both include FEM analyses of all components and simulations with different load profiles (e.g. snow or wind loads, see Figure 2) as well as a modelling of the collector structure, including the load transfer to the substructure (e.g. clamping rails or roof fastening). Life cycle analyses help to ensure the

operability of collectors over the required time span. In addition, worst case scenarios perhaps caused by erroneous assembly, are computed in order to detect potential failure points in the design. These modelling and virtual prototyping processes help us to verify the ability of components to meet the corresponding physical requirements. This allows us to detect potential failure points from the early development and design phase onwards and to make the necessary improvements. (Prototypes are implemented faster and in a more perfect way. This helps to shorten development times and reduce R&D costs).

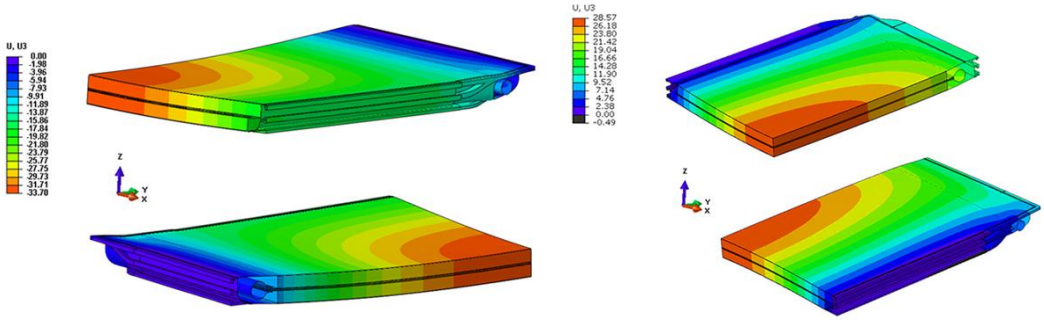

Figure 2: FEM analysis and results:
exposure of solar collectors to snow and wind loads

Special system technology for plastic-based solar collector units

If plastic-based solar collectors are to function as plug & play systems, the system hydraulics of the collector units will have to face new requirements: in order to ensure safe and easy functioning, the control mode, volume flows, and absorber hydraulics need to be synchronized. So CFD simulations are carried out in order to simulate the operating mode with different functional parameters in place. This allows us to compute even more complex flow patterns. Simulated filling modes of solar units and the flow distribution within collector panels provide useful information for the dimensioning of components (e.g. absorber or collector joints, see Figure 3).

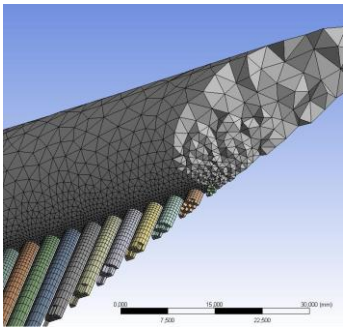

Figure 3: CFD – mesh modelling for absorber and collector