

## Abstract

### **Aging behavior of selected polymers for solar thermal absorber applications**

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In close cooperation between the Polymer Competence Center Leoben (PCCL, Leoben, A) and the University of Oslo, Department of Physics (Oslo, N) a research program was set up to investigate the aging behavior of polymeric materials for solar thermal absorbers. Different commodity and engineering plastics were selected to determine the long term performance of polymeric materials for solar absorber components.

This paper focuses on the description of the physical and chemical aging behavior of three polymers. A polyphenylene ether blend (PPE+PS, currently used in Solarnor all polymeric collectors), polycarbonate (PC) and polypropylene (PP). The reference material and the aged specimens were characterized by mechanical methods (monotonic tensile test) and by analytical methods (Differential Scanning Calorimetry, DSC; and size exclusion chromatography (SEC)) and by infrared spectroscopy (ATR). In accordance with the experiences made with the Solarnor collector, 140 °C in air and 80 °C in water were considered for aging. Maximum exposition times were 500 hours in hot air and 16000 hours in hot water, respectively.

Results showed that ultimate mechanical properties, oxidation temperatures measured by DSC and molecular weight distributions (measured by SEC) were sensitive parameters for chemical aging. For PP no evidence for chemical degradation can be found within the specified exposition time. Due to a more complex aging behavior, PPE+PS and PC exhibited a different trend in mechanical and analytical behavior. After aging in hot air, mainly PS degraded in the PPE+PS blend, confirmed by a decrease in ultimate strain. SEC results indicated a cross-linking of PPE+PS. For PC no chemical degradation in hot water up to an exposition of 2000 hours was found. By spectroscopical means additional information about the chemical degradation products, additives and fillers was generated. For PP and PPE+PS a significant diffusion of fillers was observed after an exposition to hot water after 2000 hours. Further details on the aging behavior will be described and discussed in the full paper.

Keywords: solar absorber, polymers, aging, water, air

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