



New approaches in assessment of solar UV exposure ageing materials

A. Heikkilä (1), T. Koskela (1), K. Lakkala (2), P. Kärhä (3), S. Syrjälä (4), H. Lemmetyinen (5), U. Feister (6), N. Kouremeti (7), A. Bais (7), S. Kazadzis (8), J.M. Vilaplana (9), J.J. Rodriguez (10), C. Guirado (10), and E. Cuevas (10)

(1) Finnish Meteorological Institute, R&D, Climate Change, Helsinki, Finland (ANU.HEIKKILA@FMI.FI), (2) Finnish Meteorological Institute, R&D, Arctic Research Centre, Sodankylä, Finland, (3) Aalto University School of Electrical Engineering, Espoo, Finland, (4) Tampere University of Technology, Department of Materials Science, Tampere, Finland, (5) Tampere University of Technology, Department of Chemistry and Bioengineering, Tampere, Finland, (6) German Weather Service, Lindenberg, Germany, (7) Aristotle University of Thessaloniki, Thessaloniki, Greece, (8) Institute of Environmental Research and Sustainable Development, Athens, Greece, (9) Instituto Nacional de Técnica Aeroespacial, Huelva, Spain, (10) Instituto Nacional de Meteorología, Izaña, Spain

Quantification of material degrading solar UV radiation exposure is an issue insufficiently and controversially handled in the field of outdoor material testing thus far. A majority of the experiments rely on broadband estimates of exposing UV doses, despite the knowledge on vast spatial and temporal differences in spectral distribution of solar UV exposure. In addition, they ignore the specificity of material sensitivities to UV radiation induced damages, albeit strong evidence on large differences on sensitivities does exist.

To address these questions, Finnish Meteorological Institute with partners has launched a series of multi-disciplinary research projects focusing on UV radiation induced and assisted degradation of polymeric materials. A weathering network consisting of six European sites has been established, providing a range of different levels of solar terrestrial UV radiation for natural exposure of material samples. This contribution reports the field experiments conducted within the network. Material samples have been weathered over time periods of varying lengths on the sites of the network. As indications of material ageing, changes in the properties of the samples have been examined by various post-exposure tests.

The presentation starts with describing the solar terrestrial UV radiation measurements conducted at each site during the experiment. Cumulative spectrally resolved UV exposures accumulated over the weathering periods are derived for one selected site. Property changes observed in the aged samples are overviewed. Knowledge on the spectral sensitivities of the materials is exploited to further derive a more truthful estimate on the damaging UV exposure. The difference to the broadband doses not weighted by the material specific sensitivities is demonstrated. Finally, the resulting estimates on UV exposures are used in explaining the property changes of the samples. Separation of the degrading effect of UV radiation versus other environmental factors emerging from the analysis is presented.