Ageing improvement of silicon-based resins subject to proton irradiation in spatial geostationary environment

D. Lansade¹, S. Lewandowski¹, S. Remaury², G. Sierra³, S. Solé³, S. Perraud², S. Carlotti⁴

¹ ONERA – The French Aerospace Lab, F31055 Toulouse, France
² CNES – French Aerospace Agency, 18 avenue Edouard Belin F-31401 Toulouse Cedex 9, France
³ MAP Coatings, 2 rue Clément Ader 09100 Pamiers Cedex, France
⁴ Laboratoire de Chimie des Polymères Organiques, Bordeaux INP, Univ. Bordeaux, CNRS, 16 av. Pey Berland 33607 Pessac, France

Silicon resins are polymers used on satellites as thermic control coatings (soft or hard coatings which aim is to evacuate calories through IR emissions without absorbing the sun’s radiations) as well as being transparent adhesives used in great amounts for the bonding of protecting cover glasses on the satellite’s solar panels. These resins, once subject to the harsh geostationary environment (highly energetic photons and charged particles such as electrons and protons) tend to crack and turn yellow [1][2][3].

Recent research in the field shown interest in the stabilization of these polymers towards UV radiations. Previous works⁴ demonstrated that both the addition of cellulose nanocrystals and the use of a specific catalyst for the cross-linking could enhance the stability of the resins regarding UV irradiations.

The stability of polydimethylsiloxane resins towards proton irradiation is currently being studied, emphasis being put on the reduction of the induced cracking. This presentation shows progress done in the protection of PDMS resins from proton irradiations thanks to the addition of charges at the surface of the polymer matrix. The mechanical, thermo-optical, and optical effects of the incorporation of new phases are measured both before and after proton irradiation.