IN-SITU TRANSMITTANCE AND REFLECTANCE MEASUREMENTS ON CONTAMINATED MGF2 WINDOWS

Bruno Bras, Holger Fischer, Riccardo Rampini, Christopher Semprimoschnig

ESA/ESTEC – 2201 AZ Noordwijk, the Netherlands, bruno.bras@esa.int

ABSTRACT

The technology available nowadays provide newer space missions the opportunity to achieve much higher complexity, resolution and accuracy than ever before. To take optimum advantage of this potential, more adequate characterisation techniques must be developed and more realistic mission scenarios determined. The ultimate objective is to guarantee an optimal choice of materials and processes as early as possible during the mission preparation to avoid late and costly counter-measures.

In an effort to reach current/future testing necessities, TEC-QEE has been dedicated to the development of new and complementary in-situ monitoring methodologies. The performance evaluation in the actual environment is important as it avoids exposing the test specimen to (ambient) environments that will not be seen during the actual mission lifetime and that can positively or negatively impact the measured performance.

This paper presents the obtained results of several tests using a vacuum facility with in-situ spectral measurement capabilities. The selected materials are frequently used in spacecraft systems: MgF2 windows as critical optical surfaces, and an epoxy contaminant as an outgassing source. The optical throughput of MgF2 windows were evaluated while gradually contaminated, with the UV/Vis/NIR spectra registered as a function of the amount deposited on the surfaces.

The tests were proposed by ESA’s Plato mission, planned to be launched in mid 2020s. The tests sequence comprised several transmittance and reflectance measurements as well as polarisation effects when exposed to the mission predicted contamination budget. The data achieved at this mission early stage certainly helps to evaluated different technical aspects, and to act accordingly if deemed necessary:

- Are the optical losses within the allocated margin?
- Are the materials fit to purpose (adhesive and optical material)?
- Is the contamination budget realistic?
- What are the actual optical consequences of outgassed compounds from an Epoxy resin on MgF2 surfaces?

This paper details the approach followed while defining the test, the execution of the test runs, the obtained results, and their impact/evaluation.