Training Opportunity for Irish Trainees

Reference	Title	Duty Station
IE-2019-TEC-QEE(3)	**Effects of contamination on the performance of space optics and detectors**	**ESTEC**

Overview of the unit's mission:

The Materials' Physics and Chemistry Section is responsible for assessing all material w.r.t their physical and chemical properties and property evolution for ESA's mission. This entails a detailed understanding of effects caused by the environment (ground/space). The section operates a state of the art laboratory offering a wide selection of analysis and characterisation instruments as well as space simulation facilities to evaluate materials versus the effects of the space environment (vacuum, radiation, temperature, contamination, ATOX, charging etc.)

Overview of the field of activity proposed:

Relationship between molecular contamination and wavelength specific transmission loss for optical payloads

Satellites operate in high vacuum environment, leading to outgassing of residual molecular species from polymeric materials. Whereas this effect can be minimised by good materials selection and conditioning, it cannot be entirely eliminated. In a subsequent step the outgassed molecules can re-condense on different surfaces of the spacecraft, leading to a slow build-up of molecular contamination layers over its life-time. On optical surfaces this may lead to transmission and consequently performance losses of instruments. The objective of this activity is to understand qualitatively as well as quantitatively the expected optical performance losses dependent on type of contamination over a wide spectroscopic range (UV/VIS/NIR/MIR):

- Quantify the extinction coefficient of specific model contaminants from UV to mid IR, including e.g. aliphatic/aromatic hydrocarbons, esters, and silicones.
- Establish a database from existing contamination measurements in UV/VIS/NIR as well as mid IR (FTIR) including determination of generic chemistry and film thickness. Possibly expand the database with additional experiments.
- Based on model compounds and contamination measurements, establish a model that allows prediction of spectroscopic transmission losses from knowledge of generic chemistry and film thickness.

The activity is of interest for demanding payloads such ESA Plato or Euclid Science missions or for ESA payloads to be developed under Sentinel 4 and 5.

Beside that, the candidate will be hosted use the Materials and EEE Laboratory which is a state of the art lab comprising facilities to simulate the space environment, including thermal ageing, thermal cycling, UV/particle radiation, atomic oxygen and outgassing. The properties of the exposed materials will be analysed using a variety of techniques, such as thermal analysis, thermal conductivity, flexural properties, microscopy (optical and SEM, laser microscopes), surface analysis (XPS, Raman spectroscopy, FTIR, contact angle) and mechanical analysis.

Required education:

Applicants should have completed a University course at Masters Level (or equivalent) in materials science, applied physics, applied chemistry, materials physics/chemistry.

Applicants should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team. Hands-on experience within a laboratory environment is considered an asset.

Applicants must be fluent in English and/or French, the working languages of the Agency. A good proficiency in English is required.

Specific requirements:

- good understanding of materials analysis techniques (microscopic analysis, chemical & spectroscopic, surface analysis (SEM, XPS, AFM etc)
- ability to perform experimental work in laboratory
- knowledge of the space environment

(see attached slide of changes of contamination layer during purging of vacuum facility)