Training Opportunity for Irish Trainees

Reference	Title	Duty Station
IE-2019-TEC-QEE(4)	Advanced Thermal Analysis of Space Materials	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:

Thermal analysis investigates the functional materials properties as a function of time and temperature. For that a variety of techniques are commonly used within the Thermal Analysis Lab of the Materials and EEE Components Laboratory.

Driven by the need to decide about the possible use of materials for space in a faster manner, advanced thermal analysis techniques do have the potential for that.

The aim of the training opportunity is to apply advanced techniques like coupled thermal techniques (a combination of thermo-gravimetric, calorimetric, with in-situ mass spectrometry, in –situ FTIR analysis and in-situ GC/MS analysis) and/or TTS (time temperature superposition) on on-going materials investigations at ESTEC. The first technique shall be used to analyse the thermal stability of materials (before or after space environmental irradiation), the second shall be used to analyse and predict the long term behaviour as well as long term (storage) behaviour of materials in space.

Long-term storage is a challenge for forthcoming ESA missions like MTG and METOP SG due to planned storage times of already more than 15 years. The effects of such extended storage periods on the performance of the materials and processes used is not easy to predict and requires an advanced understanding of environmental effects on materials.

The aim of the activity is to rely on advanced thermal material characterisation techniques (DDS, DMA, TMA, DSC) as well as advanced microscopic techniques (AFMs, nano-TA,) in combination with other physical/chemical analysis (FTIR, RAMAN) to derive an understanding of the intrinsic mechanisms that lead to environmental effects and degrade the functional properties of materials. It shall focus on all materials classes and shall work further on a recently finished industrial storage activities over the last two years.

The following activities are foreseen:

- Definition of test programme in relation to extended storage periods of spacecraft
- Definition of analysis programme based on the above techniques
- Execution of test programme and analysis programme
- Understanding of degradation mechanisms
- Model description of degradation mechanisms

The gained understanding shall be applied to assess and verify on-going test programmes for ESA's space missions. Specific programmes are running in support of ESA's SCIENCE & LAUNCHER and TELECOM missions.

Focus is that time savings over traditional materials testing programmes shall be reached.

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 (thermal analyses of materials, and other relevant physical/chemical materials characterisation.
- ability to perform experimental work in laboratory
- knowledge of the space environment