

Training Opportunity for Luxembourgish Trainees

Reference	Title	Duty Station
LU-2023-TEC-MSP	Advanced Materials and Process Engineering	ESTEC, Noordwijk, the Netherlands
<p><u>Overview of the mission:</u></p> <p>The Structures Mechanisms and Materials Division is the Agency's centre of competence for all areas related to spacecraft and launcher structures, and mechanisms, tribology and pyrotechnic devices, and materials and processes. This encompasses spacecraft and launcher lightweight structures, stable structures, advanced mechanical materials applications, structural dynamics, damage tolerance, deployable structures/booms, active structures, hold-down and release devices, electrical motors for space mechanisms, launcher and re-entry vehicle hot and cold structures, landing attenuation systems, seals, valves, parachute systems, separation systems, solar array drive mechanisms, reaction wheels, pointing mechanisms, pyrotechnics, bearings and tribology aspects. It provides support to projects and to preparatory and technology programmes.</p> <p>The work proposed will be carried out in the Materials and Processes Section. Activities performed within the Section's remit include:</p> <ul style="list-style-type: none"> • The qualification for space flight of all advanced metallic and non-metallic materials, structural ceramics and glasses, as well as all related manufacturing and surface treatment processes for all ESA spacecraft and launchers; • The development of revolutionary materials and innovative manufacturing technologies both internally and in cooperation with other space agencies and research organisations; • The failure investigation of materials and processes underperforming and impacting ESA space missions; • The development, certification and support of new European industrial capabilities, manufacturing processes and manpower skills training related to space applications of materials and components; • The establishment and implementation of requirements and standards for the development and procurement of space grade materials and manufacturing processes; • The development, maintenance and improvement of the European Space Materials Database, storing all relevant data generated for materials and processes intended for space use. <p>To achieve its objectives, the Materials and Processes Section manages its test facilities in the world-leading ESTEC Materials and Electrical Components Laboratory, covering the full spectrum of materials characterisation testing capabilities.</p> <p>You are encouraged to visit the ESA website: http://www.esa.int</p>		

Overview of the field of activity proposed:

The Agency has recently proposed the ESA Advanced Manufacturing Cross-Cutting Initiative, which captures the opportunity of adopting revolutionary manufacturing capabilities, advanced materials and associated processes and creates a sustainable competitive advantage for the European space industry in the global market.

Current space missions are often limited in their performance and scientific achievements by traditional manufacturing processes/concepts. Though advanced manufacturing technologies are readily available in the current European industrial landscape, these can be adopted for next-generation space hardware manufacturing. This will enable new, highly innovative spacecraft and launcher designs, with significantly reduced manufacturing constraints (including costs and lead-time) and a tremendous improvement in performance.

Through this initiative, the Agency has identified a number of highly innovative materials and associated manufacturing processes which can be spun-in to be matured to space qualification level. The following materials and processes are currently targeted:

1. Additive manufacturing: structure/property performance evaluation and model verification through mechanical and μ -mechanical characterisation
2. Friction stir welding, solid-state joining technologies for hybrid (metallic/non-metallic) joining
3. Laser shot peening for structural integrity enhancement
4. Advanced composite materials (polymers, metal, and ceramic matrix composites) and their performance characterisation and prediction in extreme environments
5. Advanced surface engineering for thermal and corrosion management
6. Solder joint reliability (mechanical and thermal fatigue) for high/low T electronics
7. Performance evaluation and whisker growth behaviour of Pb-free solder alternatives.

As a LuxYGT, you will use the world-leading facilities at the ESA/ESTEC Materials and Electrical Components Laboratory to characterise all the above advanced materials and manufacturing processes.

The aim of the work will be to perform detailed materials investigations and verification testing as well as, where required, failure investigation related to advanced manufacturing processes. The final goal is to enable in-depth understanding of the performance of the identified technologies and provide recommendations for further improvement with a view to their space application in highly demanding environments.

Required education and skills:

- You should have just completed or be in your final year at master's level in materials science covering metallic, polymeric and/or composite materials.
- Good interpersonal and communication skills
- Ability to work in a multi-cultural environment, both independently and as part of a team
- Fluency in English and/or French, the working languages of the Agency