

Internship /Proposition de stage recherche
Master /PFE Ingénieur et/ou Master M2
Université de Strasbourg - Laboratoire ICube
Fev/Mars- août 2022 - Feb/March-August 2022

Lunar dust simulant 3D printer development and test

Lab: ICube Strasbourg, France
(Laboratoire des Sciences de l'Ingénieur, de l'Informatique et de l'Imagerie)
Engineering science, computer science and imaging research institute

Equipe / Team : IPP (Instrumentation et Procédés Photoniques / Photonics Instrumentation and Processes)
en collaboration avec (équipe ICube ou entreprise...)

Context: The IPP team has developed its own 3D printer based on Selected Laser Melting as part of a larger study of lunar soil simulant sintering for lunar base applications. To replicate the lunar conditions such as the lack of atmosphere, a part of the SLS printer will be transferred into a vacuum chamber at the International Space University.

Description: The aim of this internship is to develop an in-situ lunar additive manufacturing process using lunar soil simulants [1, 2], and to find the most adapted light/matter interaction for the most efficient regolith-based manufacturing under certain lunar conditions. More specifically, in the present case, under vacuum.

Recent results are paving the way of solar 3D printing technics to make use of all the in-situ resources [3-5]. Additionally, literature provides information on absorption spectra of the JSC-1A lunar simulant, on the capability of melting [6, 7] or sintering [8] regolith or oxide ceramics and to use of an SLM machine to manufacture parts [9, 10]. Results under vacuum yields porous samples [11]. This can be considered a bonus for insulating applications or a drawback when mechanical strength is required. The latest results report on lunar soil simulants under vacuum and microgravity [12].

The approach of our team and associated partners, the Institut Clement Ader, is more focus on the thermo-optical characterisation of the various simulants to build a robust multi-physics numerical model. The developed numerical model is then used to optimise the light interaction with the matter and sinter samples with the best mechanical properties. These properties will then be characterised by optical microscope, SEM and micro-hardness.

Thanks to the grant FIGOLU obtained from the French space agency, CNES, our team is developing, in partnership with the International Space Agency, an experimental set up inside an existing vacuum chamber.

The conception of the experimental set up inside and around the vacuum chamber has already begun as a student project. The conception of the main frame inside the vacuum chamber is done and the parts are currently being manufactured. The ISU students are currently working on final assembly of the system. The trainee will first have to assist the students during the last month of their project to gain knowledge of the system. Afterwards, the trainee will complete the control part of the system (X/Y/Z/rotation stages and

laser) and run the first tests to find the most appropriate processing parameters. To evaluate the quality of the manufactured samples, the trainee will have to perform various physical measures and thermomechanical tests.

Contacts: gregoire.chabrol@ecam-strasbourg.eu

Traineeship grant /Gratification de stage :

Gratification de stage conformément aux règles en vigueur (3,90 €/h ~ 600 €/mois).

Poursuite possible en thèse/ Possible PhD position: yes/no Depends on pending and futur funding opportunities

References:

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