Séminaire de Olivier DURAND

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Salle Patrick Alnot, IJL

State of the art and recent developments in additive manufacturing technologies for bulk ceramics and coatings

The Centre for Technology Transfer in Ceramics (CTTC) is a Research and Technology Organisation specialising in technical ceramics and their manufacturing processes. From the powder to the object, the centre has a set of semi-industrial equipment and skills for the manufacturing of oxide and non-oxide ceramics parts, from the prototype scale, up to small series for process qualification.
In recent years, 3D printing, or more precisely Additive Manufacturing, has opened up the horizon of ceramic parts shaping processes. Initially confined to rapid prototyping, these new methods offer access to very complex geometries, previously unattainable by conventional processes. Moreover, these methods can now prove to be very competitive for the production of small series.
Among the Additive Manufacturing of Ceramics, two main families of additive processes can be distinguished: the so-called layer-by-layer processes, dedicated to the manufacture of massive parts; and the so-called Direct Ink Writing processes, suitable for the production of coatings according to discrete patterns. The former, more mature, are today the most widespread in laboratories and private R&D centres, while the latter are still under development, although at a relatively advanced stage.
After a brief presentation of the centre, its technological means, its activities and some examples of concrete achievements with conventional processes, the presentation will focus on the Additive Manufacturing of Ceramics, its recent history, its advantages and its limits, and then will focus on two additive technologies, each belonging to the two major families mentioned above: Laser Stereolithography and Inkjet/Aerosol Jet Printing. The implementation methodologies will be presented in detail (design files, raw material characteristics, printing parameters, post-processing), and illustrated by examples of achievements. The most recent developments will complete this state of the art. Finally, the presentation will conclude with the prospects offered by additive manufacturing in the face of major societal challenges (energy, environment, sovereignty, etc.).

Séminaire du Département Physique et Chimie des Solides et des Surfaces de l'IJL.