Detection and characterization of manufacturing defects by Laser Beam Melting: Impact on mechanical properties

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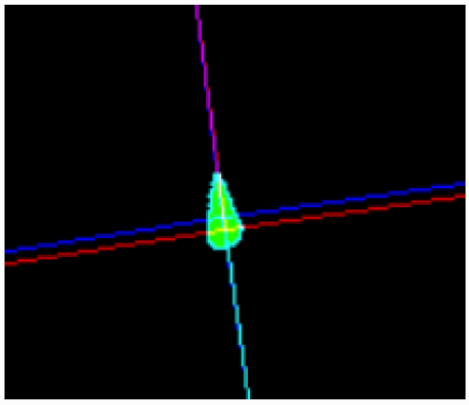

[P. VINSON – *2015*]

- Understanding of the laser-powder bed interaction phenomena
- Understanding of the defect genesis
- Detection of process defects
- Measurement of thermal field
- On-line process monitoring

Abstract:

Described by some as a "new industrial revolution", additive manufacturing technologies are increasingly present in the aeronautics and space sector, given the financial stakes, technological advances and environmental impact of these processes. With a permanent aim to reduce the development stages of parts, costs and lead times, to reduce the overall energy footprint of the production line compared to "subtractive" processes, the aeronautical and space industry and in particular ArianeGroup has high hopes in these rapid manufacturing techniques. Some companies are even thinking about large-scale implementation of these new technologies in factories of the future known as 4.0. However, certain phenomena of these processes and in particular laser-material interaction are still poorly controlled and not fully understood.

The PALOMA project is working to consolidate the entire production chain, from powder to piecework, with a view to the imminent industrialization of certain parts. In fact, this project focuses on the development and improvement of two additive manufacturing processes, Selective Laser and Electron Beam Melting of metal powder beds. It follows on several major structuring projects such as PROFILE and FALAFEL initiated by the GIFAS (Groupement des Industries Française de l' Aéronautique et du Spatial). PALOMA's objective is therefore to continue developing this manufacturing technology from a pre-industrial to a fully industrial stage in order to develop structural parts with good metallurgical quality. The innovation of this project is based on the provision of an open machine, allowing the measurement of the thermal fields during manufacture. By these methods, we will try to understand laser-powder bed interaction and defect genesis. Using an on-line process control will allow the detection, identification and quantification of defects in the part volume. The main material of this project remains TA6V, but a stainless steel is also considered.