12 month Post-Doctoral position (SIMAP Laboratory, Grenoble INP, France)
3D metallic printing by extrusion of powder-polymer mixtures

Additive manufacturing refers to all processes where the material is added directly to manufacture a part from a digital model. These processes optimize properties and reduce raw material and machining costs by directly placing the right material in the right place. They also open up possibilities for the manufacture of products not accessible by usual processes and make it possible to bridge the gap between the design of complex architectural parts and their manufacture, for multifunctional specifications. In the energy sector, efficiency improvement of heat exchangers can thus be considered.

3D metallic printing most often uses a powder bed deposition followed by electron beam melting (EBM) or laser beam melting (LBM) local consolidation. However, these techniques are limited to the manufacture of mono-materials for high value-added applications (aerospace, biomedical). More recently, low-cost 3D printers have appeared on the market based on the 3D plastic fused filament technique (FDM), but using powder-polymer mixtures as raw material. The printing of various metallic alloys can be considered, based on the experience of injection moulding (MIM) for the supply of raw material granules. The debinding/sintering steps allows the powder to be consolidated and the porosity of the material to be adjusted using an appropriate heat treatment.

The aim of this project is to study the development of parts with complex geometry of mono or multi-materials by this technique. Copper heat sinks and heat exchangers for application in power electronics will be printed and sintered. The removal of organic compounds, the formation of porosities on printing, their elimination during sintering and the shape distortion of parts will be particularly studied. The production of multi-material steel/copper parts of complex architecture will then be discussed for application in plastic moulding, with the aim of controlling the co-sintering of the 2 materials. This experimental work will be carried out in SIMAP laboratory, in partnership with G2Elab (design and characterization of heat sinks for power electronics) and in collaboration with CEA LITEN (MIM expertise).

Example of a copper cooling unit.

Profile required: PhD in Materials Science
Skills: Experimental work in Materials Processing and Characterization, experience in Powder Metallurgy and Additive Manufacturing appreciated.
Post-doctoral grant : Carnot Institut « Energie du Futur », 2300€/month net salary.
Place of work : Lab. SIMAP of Grenoble INP, collaboration with G2Elab and CEA LITEN.
Period : 12 months, from 2020/02/03 to 2021/01/29.
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