

MaMaSELF



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Fe-Base Alloy design for Additive Manufacturing

Additive Manufacturing is a new and continuously growing market, for that reason much work is being done by many companies and research institutions to optimize this promising production process still without exploiting.

Additive manufacturing offers many advantages that traditional production methods can't rather due to geometrical or process restrictions rather for economical reasons. Additive Manufacturing is defined as "the process by which digital 3D design data is used to build up a component in layers by depositing material" (International Committee F42 for Additive Manufacturing Technologies, ASTM).

The advantages of this technology is that the raw material is directly transformed into the finished piece, forgetting the intermeddle processes, and is not restricted by the conventional manufacturing constraints. So the market possibilities are as broad as you can imagine.

The functional principle is scoping an application, then developing a material for this app requirements, a 3D CAD model is done and some simulations for optimizing the material and the 3D printing process are done and then the materials processing and layering is studied, selecting the parameters for the printing window to obtain the final piece. This is an iterative process that helps us to affine and optimizing the process and parameters.

There are many additive manufacturing technologies depending on the materials they can process, the cost, accuracy, speed of scanning, layer thickness and the technique applied to create the layers and to join them.

ArcelorMittal is interesting in all kind of materials and technologies, but due to its strategic position in the market, there is a preferred interest in metal alloy design, especially, Fe-based alloy. In this field the most used technology for 3D printing purposes is SLM (Selective Laser Melting). However, a lack of suitable materials for this application is a fact, and this is because the extreme conditions the material is submitted during the atomization process and during the melting-printing process. Here it is where all the actual work is focusing to try to understand the thermodynamics and the external factors which can affect too. Moreover the little list of the metal alloys used nowadays in 3D printing were not develop for this purpose, so improving these alloys is a must regarding two ways: 1) Improving the final physical and mechanical properties of the material and 2) improve the processability of the material using the Additive Manufacturing Facilities.

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