Proposition sujet de stage **2018 - 2019**
MASTER Recherche

Titre du stage : Assembly of titanium subparts made with an EBM technology

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Description du sujet

Context

The Electron Beam Melting (EBM) is an additive manufacturing technology. It is an alternate additive metal process in comparison to Direct Metal Laser Sintering (DMLS) and an interesting solution for parts built using Ti-6AI-4V. The EBM machine uses an electron beam gun to melt metal powder at micron-scale layer thickness, and builds solid details that have homogeneous material structure. As EBM is an additive manufacturing process, the possibility of shape is endless and comes with tremendous benefits. For example, the ability to achieve a high-energy level in a narrow beam and the vacuum melt quality that can yield high strength properties of the material. However, there are some limitation concerning the maximum build size. As example, the Arcam EBM A1 machine has a maximum build size of 200 x 200 x 200 mm. Some parts are be too big to manufacturing with this technology. Therefore, there is a need to find the way to decompose and assemble subparts into the desired part.

Objective and Problematic

The proposed work focuses on the following problematic: How to assemble subparts made by EBM technology to obtain the same part functionalities for the final part as if it had been done in a one part.

We consider that a complete assembly is made of two complementary functions: positioning and maintaining.

A previous work focused on a welding process made by Electron Beam (EBW: Electron Beam Welding) to achieve the maintaining. It was done in collaboration with the Lepton Company. A first set of experiments, with different welding strategies and welding parameters' values, was carried out using specific samples. The shape of these specific samples was the result of an empirical approach. Tensile tests were then conducted on these samples to quantify the strength and elongation values of these EBW parts. From these first results, a welding strategy was chosen and the Design of experiment method applied for choosing the best welding parameters' values was planned. A first objective is to lead this set of experiment and to determine the most appropriate value of the welding parameters for achieving this maintaining function by EBW.

A second objective is to study and define potential shapes for the interfaces of the subparts to be welded using an Electron Beam process. These shapes might ensure the positioning function in the context of use of the part made of the different subparts.

Finally, and depending on the progress for the first two objectives, a third objective is to propose a broader view on the means to perform both functions. The usage conditions of the solutions considered will have to be characterized.

Pré requis

No specific knowledge as prerequisite for this work.

However, a technological background is expected from the candidate, and a focus interest on additive manufacturing technologies is highly welcome.

In addition, obviously curiosity, rigor and desire to learn will be appreciated.