

Cold spray for high strength and high conductivity copper alloys

General scope:

The Laboratoire National des Champs Magnétiques Intenses (LNCMI) of Grenoble is one of the large scale research infrastructure of the CNRS. It provides access to the highest possible magnetic fields to the scientific community. High field magnets are made of concentric coils supplied by large direct electrical currents (~30 000 A) Due to Lorentz forces and Joule losses, high field magnets require materials with high mechanical strength and high electrical conductivity.

A collaborative works between LNCMI/CNRS and ICB/UTBM has started in 2012 to develop new materials to achieve the required properties by using the cold spray additive manufacturing.

CuAg and CuCrZr cylinders of variable sizes were developed using the cold spray process. High yield strength (minimum of 510 MPa) and high conductivity (minimum of 52 MS.m⁻¹) were obtained for CuAg alloys.

One of the identified phenomenon occurring during cold spray is the adiabatic shear deformation that contributes to the cohesion of the impacting particles to the substrate.

The goal of this internship is to obtain a deeper understanding of the microstructural features that can be observed in a cold spray deposit as well as to find the key parameters to optimize the properties of the cylinder. The potential tuning parameters are ranging from the raw powder properties to the heat treatment along to the deposition parameters.

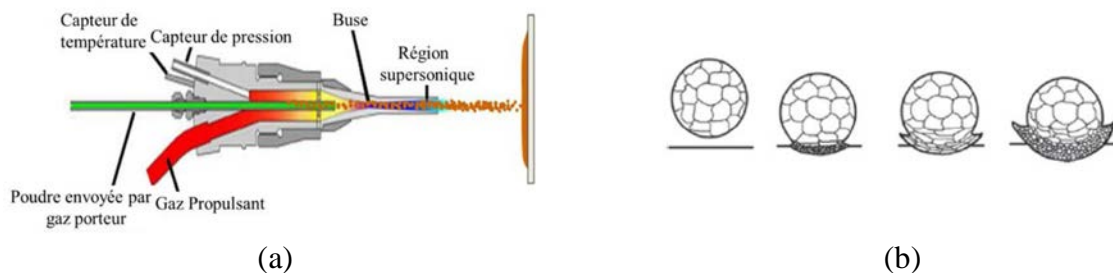


Figure 1 : (a) Schema of the cold spray deposition process and (b) schema of a particle impacting the substrate.

Education/ Required skills:

Master in materials science: crystallography, alloying, severe plastic deformation. Basic knowledge in microscopy (optical, scanning electron beam, transmission electron beam).

Startdate: 2020

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