

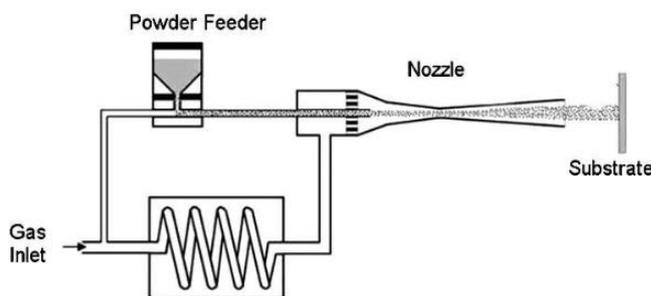
# Surface properties of non-equilibrium materials obtained by powder beds or sprayed powders:

## *Application to surface post-treatments by impact for the finishing of Additive Manufacturing parts*

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- Additive manufacturing
- Cold spray
- Laser Beam Melting
- Surface properties : roughness, porosities, residual stress

*Schematic of the conventional cold spray process principle [1]*

### **Abstract:**

Additive processes involving the melting powder bed or the spraying of powders are used to manufacture or to repair industrial parts. The powder is deposited incrementally in layers, and generally steep thermal gradients are generated during the cooling down leading to non-equilibrium state of the material. Generally, the free edge surfaces exhibit different microstructural, metallurgical, and morphological characteristics if compared to the bulk. Therefore, post-treatments can be considered to better control the features of the surface. This issue about the finishing surfaces in the additive manufacturing route is crucial for the life of the parts. Functionalization of the surface by a coating can also be envisaged.

In this thesis work, we aim to extend the knowledge of the specific characteristics of the surfaces of materials resulting from "powders" processes (cold spray or LBM), as-processed or post-treated mainly using impact surface treatments like for example laser shock, cold spray and dry ice treatment with facilities that are available in the laboratory. Surface characterization will include the microstructural and morphological assessments of the surfaces but also the mechanical using XRD analysis of residual stress. Numerical tools are also envisaged to help the prediction of the material's behaviors under impact processes. This exploratory study will concern the case of pure alloys (Al base, Ni base typically) to develop the methodology, but could extend eventually to other materials including bi-material composites or other alloys for industrial purposes.

[1] V. Champagne, D. Helfrich, P. Leyman, S. Ahl, et B. Klotz, « Interface material mixing formed by the deposition of copper on aluminum by means of the cold spray process », *J. Therm. SPRAY Technol.*, vol. 14, n° 3, p. 330- 334, sept. 2005.