

# MATERIALS SCIENCE AND TECHNOLOGY

## Lightweight alloys design and development for AM

<b>Funded By</b>	Politecnico di TORINO [P:iva/CF:00518460019]
<b>Supervisor</b>	MANFREDI DIEGO GIOVANNI - diego.manfredi@polito.it
<b>Contact</b>	
<b>Context of the research activity</b>	<p>Among the various metal Additive Manufacturing (AM) techniques, the focus is on lightweight alloys design and development for the Powder Bed Fusion processes. The starting materials are spherical gas-atomized powders. The main goal is to verify the feasibility of processing powders of new lightweight alloy compositions produced with the gas atomizer at Politecnico di Torino. The produced samples will be characterized in terms of microstructure, mechanical and functional properties.</p>
	<p>Over the last decades, metal Additive Manufacturing (AM) has been heading a fundamental revolution in the manufacturing industry for its capability of both fabricating objects with an unprecedented design freedom and materials with unique microstructure and properties. To date, the number of alloys commercially available for powder based AM technologies is rather limited and the research and development of new alloys is of extremely high interest. Exciting material research opportunities can be perceived in taking advantage of the metallurgical effects of the high cooling rate during metal AM, namely the refinement of the microstructural features and of segregation scale, the precipitation of metastable phases and the formation of supersaturated solid solutions. These effects generally increase material strength, also by enhancing their compositional homogeneity and can be promising for heading ad-hoc alloying strategies aimed to develop new high-strength Aluminium alloys. In particular, the development of new formulations of Aluminium based alloys, including the use of ceramic particles at micro/nano scale, is on going at the Politecnico Campus in Alessandria thanks to the possibility of using a dedicated gas-atomization plant.</p>

## Objectives

A fundamental part is then the feasibility study related to the use of these new alloys in powder based AM systems.

The main research objectives of this PhD thesis are the following:

- o Process parameters optimization to verify the feasibility of new compositions of gas-atomized Aluminium based alloys powders by AM
- o Study of material microstructures, physical, functional and mechanical properties and their modifications on the basis of raw materials features and processing conditions
- o Study and optimization of post-processing treatments (in terms of heat treatments and surface finishing), defining their influence on mechanical and functional performances of final components.

## Skills and competencies for the development of the activity

Candidates should have a solid engineering background, attitude to work in team and strong self-motivation to learn through advanced research.

Expertise in materials science, advanced processes and technologies, mechanical behavior and characterization of metallic materials is a plus.

Problem solving ability and practical attitude for the experimental part of the PhD program are appreciated.