



# PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

**PNRR 117 Research Field: POST-PROCESSING OPTIMIZATION FOR ADDITIVELY  
MANUFACTURED AEROSPACE ALLOYS**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1400.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

## Context of the research activity

**Motivation and objectives of the research  
in this field**

Metallic materials manufactured by additive technologies have different microstructures and properties from those produced by conventional methods. Thus, tailored heat treatments are required to tune the mechanical response of components produced by AM. Traditional heat treatments (e.g., solution plus ageing) do not take advantage of the material microstructure resulting from AM and, depending on solution temperatures, they can also decrease the strength of the material. The aim of this PhD project is the optimization of heat treatments for aerospace alloys and components produced by AM. The optimized heat treatments may give a material with higher mechanical properties than the one in the as-built conditions. There are very few systematic comprehensive studies about how the different thermal treatments of AM-processed aerospace alloys influence their mechanical properties. For this reason, extensive mechanical testing will create a comprehensive study of mechanical behaviour for this kind of alloy. Furthermore, the work will provide necessary information to what extent surface finishing will impact fatigue behaviour (HCF) for selected aerospace alloys. It is generally understood that surface characteristics will decrease the fatigue properties for high-strength materials and so can also be predicted using mechanical modelling. The key is here to understand how the specific surface of AM-fabricated parts will affect behaviour and how the selected post-AM process will tune the surface.



<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>The PhD project will include different research aspects ranging from material microstructure optimization to thermal treatment design and material performance evaluation. In particular, the PhD research will focus on: - Implementation of advanced statistical methods for optimal and robust design of experiments aimed at achieving the best sets of heat treatment conditions and parameters by maximizing the efficiency (minimal number of runs) and effectiveness of the experimental efforts. This may represent a best practice for further material development analysis beyond the specific goals of the current project. - Mechanical testing for AM-fabricated aerospace-base materials for mapping of performance assessment related to LCF, HCF, crack growth and role of surface characteristics.</p>
<b>Educational objectives</b>	<p>During the 3-years education, the candidate will become familiar with all the aspects related to the design of thermal treatments of aerospace alloys produced by AM. The research will provide the opportunity to achieve high-level skills in the areas of metallurgy of aerospace alloys, related investigation techniques and mechanical testing of metallic alloys.</p>
<b>Job opportunities</b>	<p>The PhD graduate will have high-quality theoretical and technological expertise in the field of additive manufacturing for aerospace applications. The competencies acquired during the research will be appealing to manufacturers of aerospace parts as well as aerospace companies.</p>
<b>Composition of the research group</b>	<p>2 Full Professors 1 Associated Professors 1 Assistant Professors 8 PhD Students</p>
<b>Name of the research directors</b>	Prof. Antonio Grande

#### Contacts

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Leonardo S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	TU Graz (AT)
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>The PhD candidate will receive a desk, possibly through a hot-desking procedure, and a personal computer, if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses and receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.</p>