

# PhD in Materials Science and Technology

## Research Title: Joining and coating for extreme operating conditions

<b>Funded by</b>	Ateneo
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<b>Context of the research activity</b>	<p>The joining and coating of advanced materials were identified as key enabling technologies to innovative and sustainable manufacturing. These technologies are very important to strategic sectors, such as the energy and transport ones, because of increasingly challenging environments and the aging and life extension of components.</p> <p>A critical issue for the wider use of ceramics and CMCs is the development of inexpensive, reliable and user-friendly joining methods to assemble large components. If the issues related to joining advanced ceramics and CMC are solved, they will be much more extensively used to produce several 'hybrid' structures, constructed of two or more different types of material, each contributing with unique properties and complementing the properties of the other for several applications strategic for the EU, such as aerospace applications, energy production, wind energy, furnace technologies, security (ballistic materials), automotive, trains and friction materials (ceramic brake discs).</p> <p>Furthermore, surface protection, including corrosion protection and permeation barrier have been the main functions of coatings in the past. In more recent years, many new opportunities have arisen for coatings to provide products with innovative new functionalities (such as self-healing, anti-fouling, sensing, etc.)</p>
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	<p>Chemical and thermo-mechanical incompatibilities between the different materials to be joined and coated (thermal expansion, ductility, fatigue/fracture mechanics, elastic modulus etc.) can create problems both for the joining and coating process itself, but also for the structural integrity of the components during their use. The joining and coating materials and processes must be designed to minimise these differences.</p> <p>In this research, new joining and coating materials and techniques for advanced materials will be investigated, together with other innovative techniques, such as advanced surface engineering.</p>
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<b>Objectives</b>	<p>The main objectives of the research are the development of:</p> <ul style="list-style-type: none"> <li>• the development of new joining and coating materials and techniques for advanced materials (ceramics and composites);</li> <li>• the study of advanced surface engineering to maximise adhesion at the interfaces;</li> <li>• the characterization of joined and coated materials in relevant conditions.</li> </ul> <p>In order to reach these goals, the experimental activity will be carried out at the GLANCE team's laboratories (<a href="http://www.composites.polito.it/">http://www.composites.polito.it/</a>) and at the inter-departmental research center J-TECH@POLITO (Advanced Joining Technologies at the Politecnico di Torino, <a href="http://www.j-tech.polito.it/">http://www.j-tech.polito.it/</a> )</p>
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<b>Skills and competencies for the development of the activity</b>	<p>The candidate should have competencies and interest in the field of materials science and engineering.</p> <p>Experience on joining and coating of advanced materials, attitude to work in an international team, together with the availability in spending research periods abroad, will be appreciated.</p>
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