# Supervisor Expression of Interest
## MSCA-IF Marie Sklodowska Curie Action - Individual Fellowship 2020

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<tr>
<th><strong>Supervisor name:</strong></th>
<th>Elisabetta Gariboldi</th>
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<td><strong>Email address:</strong></td>
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<td><strong>Link pagina docente:</strong></td>
<td><a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ricerca/RicercaPerDocentiPublic.do?k_doc=75104&amp;lang=EN&amp;EVN_PRODOTTI=evento&amp;polij_device_category=DESKTOP&amp;_pj0=0&amp;_pj1=5da405380387785d4a29473a1775f1de">Link pagina docente</a></td>
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### Department Name:
**Research topic:**
[(https://www.polimi.it/en/scientific-research/research-at-the-politecnico/departments/) Mechanical Engineering Department (DMEC)]

- PE5_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles
- PE8_8 Materials engineering (biomaterials, metals, ceramics, polymers, composites, etc.)
- PE4_17 Characterisation methods of materials
- PE5_1 Structural properties of materials
- PE7_3 Simulation engineering and modelling
- PE8_12 Lightweight construction, textile technology
- SH2_8 Energy, transportation and mobility

### MSCA-IF Research Area Panels
- xENG_Information cience and Engineering

### Politecnico di Milano Areas:
- Industry 4.0

### Brief description of the Department and Research Group (including URL if applicable):
The mission of the Department of Mechanical Engineering is to promote and develop culture, research and innovation in its sectors of reference, but also in new fields doomed to become more and more important in society and in our present background. For example, it specifically deals with transports and sustainable mobility, power technologies, biomechanics and service robotics, bio-materials, smart materials and hybrid materials, manufacturing and production systems, space and security. Within the Mechanical Department, the activities of the Advanced Materials research group are related to metallurgy and the processing of advanced and non-conventional metallic alloys such as nanostructured and ultrafine grained metals, aluminium, magnesium and titanium alloys for special and highly-demanding applications, non-ferrous superalloys and related coatings for high-temperature service.

Prof. Elisabetta Gariboldi operates within this group, with activities related to the high-temperature structural and functional properties of fully metallic or composite/hybrid materials (within which thermally activated materials), for their development/optimization of in view of specific application fields.
**Brief project description:**

(max 1 page)

Thermally activated composites or structures are materials which microscopic and macroscopic properties change with temperature, often above a triggering temperature. They include a wide range of materials and components, many of them composites. Among them, several include Shape Memory Alloys, such as those referred as Controlled Behaviour Composite Materials, which thermal activation in view of specific deformation, stresses, or stiffness changes can be accomplished and controlled by means of specific additional phases causing local heating and thus controlling (also locally) the overall material properties of interest. Also the thermal stimulus can be of extrinsic or intrinsic origin.

There are other composite structures or material classes that, like CBCM, are thermally activated. They are made by a different combination of phases, size range and, specifically, with a with range of thermally activated properties, activation temperature ranges, phases combined together and their arrangement pattern. Examples are in the thermally activated thermal response of Phase Change Materials, in which, as an activation temperature is reached, an occurring phase transformation completely modifies the thermal properties of the material in a way that also depends on the transformation kinetics and degree completion. By acting as thermal storage materials, these materials are suggested in the thermal management of buildings and solar energy storage means. As for CBCS, multiphase composite/structures including PCM can be produced to adds up additional structural or functional properties to thermal storage.

Similarly, several classed of self-healing, or healable materials can be considered as thermally activated materials, and many of these materials are inhomogeneous materials.

Thermally activated materials need to be designed or selected on the basis of specific thermal responses require proper design procedures, manufacturing process and quality control. When a controlled behaviour has to be repeated several times in the service life of the part, the overall composite material/structure as well as the single phase should be stable.

The principles for the design of the above material classes, which often include a polymeric or ceramic matrix, can also be metallic-based.

The aims projects is two-folded. On one side to develop a material class of metallic-based thermally activated composite materials where the thermal-management properties support the self-healing properties of the composite itself. On the other side develop corresponding design strategies to be applied in simple reference parts in which the material can repair in a controlled way and time under extrinsic or intrinsic heating.