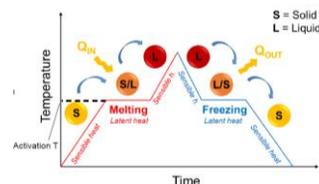


This webinar of "MATERIALS MATTER!" deals with the fundamental topics of the EIC Pathfinder project "M-TES – Metallic phase change materials-composites for Thermal Energy management".

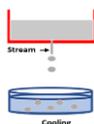
## Metallic Phase Change Materials-composites for thermal energy Management

The introductory talk gives an overview to the reasons leading to the development of metallic phase change materials for the field of thermal storage and management. These materials, based on immiscible alloy systems, are quite peculiar for behaving at the same time (or alternatively) as alloys or composite materials. The M-TES project, which specifically addresses some of these issues, is shortly outlined.



Prof. Elisabetta Gariboldi is full professor in Metallurgy at POLIMI, DMEC. Her research was mainly devoted to analyze microstructure-properties correlations at high temperature. Since 2016 she is working on PCMs (8MS and 3 PhD theses supervised, 20 papers in Scopus).

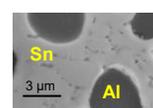
### Theoretical considerations for metallic PCMs casting



In the present work, a set of Al, Cu and Sn-based alloys and metallic PCMs, with different compositions, were produced through induction melting followed by water granulation. The shape and morphology of the obtained cast products were analyzed by image analysis. Results were correlated to material properties and casting/pouring conditions, trying to establish a correlation with theoretical studies related to similar processes.

**Humaira Arshad**, research fellow at CNR-ICMATE (Lecco), M.Sc. in Physics. She has research experience in synthesis and characterization of nanomaterials for medical applications. Currently she is working on theoretical calculations and characterization of metallic phase change materials.

### Microstructural and calorimetric properties of Al-Sn-based PCMs

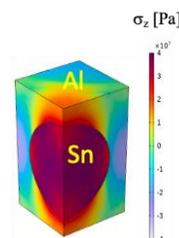


In this study, composite metallic PCMs based on commercial Al alloys and Sn were produced through a graining process and characterized by calorimetric and microstructural analyses in both as-produced and thermally-cycled condition. Scanning electron microscopy allowed to analyse the microstructure of Sn, characterized by dispersed nanoparticles and eutectic lamellar structures. Calorimetry confirmed the presence of eutectic dispersed phases. Moreover, phases morphology evolution upon thermal cycling was investigated. This work wants to study the influence of minor elements on the behavior of these alloys.

**Dr. Francesca Villa**, researcher at CNR-ICMATE (Lecco), M.Sc. in Materials Engineering, PhD in Mechanical Engineering. Her main research interests include the design, production and thermal, mechanical and microstructural characterization of functional metallic materials and metallic phase change materials.

### Experimental and numerical analyses of C-PCMs performances

Within the context of C-PCMs, selected Al-Sn-based systems are introduced. Temperature-dependent thermophysical and mechanical properties, strictly related to the C-PCM performances, are assessed in both as-produced and heat cycled condition. Alongside this task, experimental results are compared with the analytical/numerical-derived ones, mainly addressed on one side, to the material properties temperature dependency and on the other, to the PCM performance evaluation and their related stability. The activities are all addressed toward a complete knowledge of the Al-Sn-based PCM behaviour, which is crucial for their proper design in real working conditions.



**Dr. Matteo Molteni**, researcher at POLIMI, M.Sc in Materials Engineering, PhD in Mechanical Engineering. He has started working on metallic PCMs since his master thesis, broadening his expertise within the framework of his PhD thesis. He had the chance to explore different production technologies and compositions, evaluating the impact of these latter on PCM performances from microstructural, functional and mechanical point of view. The understanding and optimization of C-PCMs was approached by simulations on PCM thermal behaviour and PCM-based material properties modelling.

In collaboration with:



POLITECNICO  
MILANO 1863

In the framework of:

Webinar "MATERIALS MATTER!"

Prof. Elisabetta Gariboldi, Politecnico di Milano

Humaira Arshad, Dr. Francesca Villa, CNR-ICMATE Lecco

Dr. Matteo Molteni, Politecnico di Milano

17 December 2025 h 15:00 – 16:30

[PARTICIPATION LINK](#)

