

## Ph.D. Course in Materials Science and Nanotechnology

University of Milano-Bicocca, Department of Materials Science, via Cozzi 55, 20125 Milano

**February 21, 2020 – 2.00 p.m.**

**Seminar room - Department of Materials Science U5**

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## Van der Waals epitaxy and characterization of quasi-two-dimensional Ge-Sb-Te alloys and superlattices

Phase change materials (PCMs) along the  $\text{Sb}_2\text{Te}_3$ -GeTe pseudo-binary line are used as the active material for non-volatile solid-state memories. Impressively, it was demonstrated that PCM memory cells based on superlattices (SLs), structures made of alternating  $\text{Sb}_2\text{Te}_3$  and GeTe layers, showed dramatically improved performance. Moreover, strain engineering has been proposed in chalcogenide SLs to shape the switching functionality for phase change memory applications.

I will first present our results on the growth and characterization of epitaxial  $\text{Sb}_2\text{Te}_3/\text{GeTe}$  SLs. Recently we unveiled an intriguing deviation of these structures from purely two-dimensional systems.

Strikingly, an unparalleled distribution of lattice parameters, which is tunable, develops in the heterostructures. Also, it allows to realize strain engineering in such weakly coupled systems.

In the second part of the talk I will present the study of the structural and thermoelectric properties of epitaxial  $\text{Sb}_{2+x}\text{Te}_3$  films, as these represent an intriguing option to expand the concept of strain engineering in chalcogenide SLs. A combination of X-ray diffraction and Raman spectroscopy, together with dedicated simulations, allowed unveiling the structural characteristics of the alloys. The strong link existing between structural and thermoelectric properties will be shown.

As an outlook, I will show preliminary results concerning the development of Ge-rich GeSbTe alloys for automotive application, in the framework of the EU project BeforeHand.

PhD students and all interested in the seminar are kindly invited to participate.

The PhD Coordinator  
Prof. Marco Bernasconi