

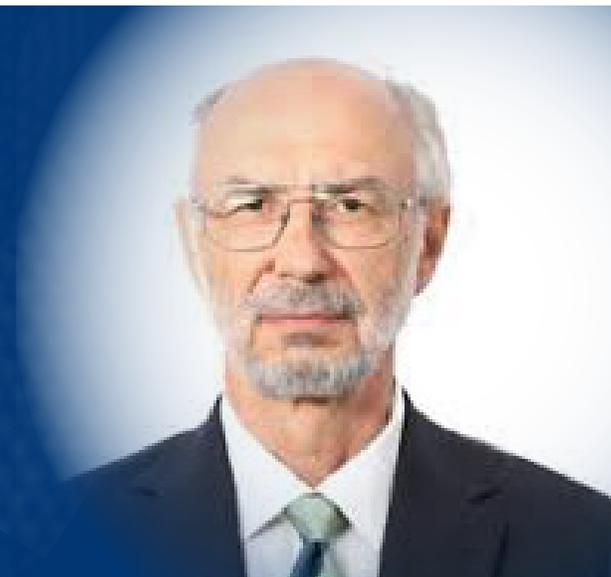
CENTER FOR RESEARCH IN SOFT MATTER & POLYMERS

CRISP SEMINAR

Tuesday, Oct. 1, 2019

10:00 a.m.

366 Colburn Lab



“Design Criteria of Advanced Nanomaterials from the Basic Understanding of Thermal Energy Storage Mechanisms“

Despite the strong request from the Concentrated Solar Power (CSP) industry, the design and synthesis of new materials with enhanced heat capacity is still suffering from the lack of a fundamental knowledge on the heat capacity enhancement mechanisms although, experimentally, a lot of effort is made, specially on nano-materials (NMs). The emphasis on NMs is due to the fact that, in our days, nano-structuring is appearing as a way to expand thermal limits of bulky materials.

To fill this lack, we present a study based on Molecular Dynamics models and simulation result analysis of nano particles (NPs) in ionic systems (suspending material, SM), from room temperature (SM in the solid phase), to high temperature (SM in the liquid phase). Two classes of NPs are used: one characterized by purely repulsive NP-SM interactions, and the other by attractive NP-SM interactions. The analysis of the results is performed by using ad hoc developed relations on non-ideal mixtures of NP in bulky materials, and the unifying theoretical framework of surface solid phonons and surface liquid phonons.

This theoretical approach, which allows a clear identification of the mechanisms leading to the specific heat enhancement/decrease of NMs with respect to the SMs, will be presented and discussed at length. The presentation is closed by the illustration of the use of the gained knowledge to develop design criteria of new NMs with improved thermal properties.

Bruno D'Aguanno

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Bruno D'Aguanno is a condensed matter physicist. His current research interests include the development of models and algorithms for the design of: (i) nanomaterials, nano-structured materials, polymeric membranes, and simple and complex fluids, (ii) innovative systems for thermal energy storage, (iii)

Polymer Electrolyte Membrane and Regenerative Fuel Cells, as well as (iv) heliostat fields for Concentrated Solar Power applications. In his career he joined the CIC Energigune (Spain), the CRS4 (Italy), the Konstanz University (Germany), and the Free University of Berlin (Germany).

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