Matthieu Micoulaut

Title: *Reversibility in Glasses*

Abstract: Given its "off-equilibrium" nature, the liquid to glass transition is by essence a kinetic phenomenon which manifests by large thermodynamic variations during cooling/heating cycles across the glass transition. Here we will review the notion of reversibility in glasses, and present Molecular Dynamics simulations showing that certain glass-forming liquids are found to exhibit minuscule thermodynamic changes during such cycles, and therefore define glassy materials that can be viewed as "thermally reversing" given the obtained optimal volumetric or enthalpic recovery.

When the topology of the corresponding network structure is analyzed, it is found that such "optimal" liquids actually adapt under stress by experiencing larger bond-angle excursions indicative of a softening of underlying bond-bending interactions, and exhibit stress-free (isostatic) character. Additional anomalous behaviors are also found. in dynamic and structural properties. Ultimately, these results show close connections with experiments on network glasses, and thermally reversing compositional windows, widely observed in chalcogenide, modified oxides and solid electrolyte glasses which are signatures of rigid but unstressed networks that form a so-called "intermediate phase." These findings substantiate the notion of rigidity in disordered molecular systems, while also revealing new implications for the topological engineering of glasses.

Biography: Matthieu Micoulaut is Professor of Physics at Université Pierre et Marie Curie (UPMC) in Paris, France http://www.lptmc.jussieu.fr/user/mmi/. He received his Ph.D. from the same university in 1993. His research centers on basic aspects such as the theory of disordered solids, oxide and chalcogenide glasses, phase change materials, and glass transition. He has been also involved in the field of granular media, and out-of-equilibrium processes which have led to industrial applications in the field of mechanical engineering, surface treatment and fatigue life improvment. In recent years, he has been actively involved in the characterization of new glassy stress-free phases with unusual physical properties. He has received the Stanford Ovshinsky Prize Award for Excellence in Amorphous Chalcogenides in 2009, and has been selected as a Fulbright Fellow in 2013.