CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE
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Mercredi 11 janvier 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Vitrimers

Ludwik Leibler

Matière Molle et Chimie, ESPCI

with Damien Montarnal, Mathieu Capelot, François Tournilhac

We will discuss a concept and practical realizations of a glass transition by reversible topology freezing of a molecular network. Permanently cross-linked materials, like thermosets or rubbers, have outstanding mechanical properties and solvent resistance, but they cannot be processed and reshaped once synthesized. Non-cross-linked polymers and those with reversible cross-links are processable, but they are soluble. We design epoxy networks able to rearrange their topology by exchange reactions without depolymerization and show that they are insoluble and processable [1]. Unlike organic compounds and polymers whose viscosity varies abruptly near glass transition, these networks, vitrimers, show Arrhenius-like gradual viscosity variations just like vitreous silica. Like silica, the vitrimers can be wrought and welded to make complex objects by local heating without the use of molds. The concept of a glass, made by reversible topology freezing in epoxy networks can be readily scaled up for applications and generalized to other chemistries. Vitrimers constitute thus a new class of materials that are processable, repairable, and recyclable like thermoplastics yet insoluble like thermosets or elastomers. Their behavior ressembles that of amorphous silica, but they are organic materials and therefore much lighter and less breakable than silica. In contrast to all organic materials, which are fragile glass-formers, the vitrimers are strong glass-formers.

[1] D. Montarnal, M. Capelot, F. Tournilhac, L. Leibler, Science 2011, 334, 965-968.

A coffee break will be served at 11h00. The seminar will be given in English.