Séminaire du laboratoire PIMM

Jeudi 11 mars 2021 à 13h sur Teams

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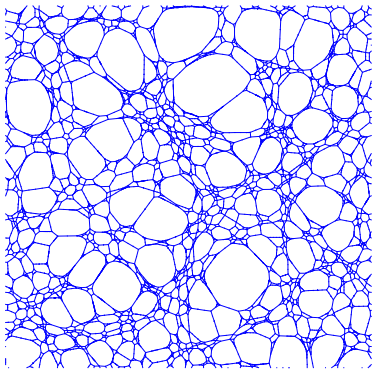
présentera dans le cadre du séminaire ses travaux intitulés :

Micromechanics of near-ideal polymer networks

Understanding the relationships between the structure of polymer networks and their mechanical properties remains a long-standing challenge in polymer physics. In recent years, a new paradigm for network formation has emerged, whereby near-ideal hydrogels are produced by the cross-coupling of branched macromolecules with well-defined chain length [1]. Such near-ideal networks constitute an excellent model system to revisit this question, as well as a promising platform for the design of new materials with tuneable properties. In this work, we systematically investigate the relative contributions of various network parameters (chain length, crosslink coordination, fraction of second-order loops) to the elasticity of near-ideal polymer networks using a computational random network model [2,3]. Numerical results are compared to classical estimates of rubber elasticity theory. Our results highlight the role of the chain pre-stretch on the mechanical response, as well as the importance of topological defects on the elastic properties. We also compare our results to experimental data for near-ideal tetra-arm PEG hydrogels.



References:

[1] Sakai, T., Matsunaga, T., Yamamoto, Y., Ito, C., Yoshida, R., Suzuki, S., Sasaki, N., Shibayama, M., Chung, U.-I., 2008. Design and fabrication of a high-strength hydrogel with ideally homogeneous network structure from tetrahedron-like macromonomers. Macromolecules 41, 5379-5384.

[2] Alame, G., Brassart, L., 2019. Relative contributions of chain density and topology to the elasticity of two-dimensional polymer networks. Soft Matter 15, 5703-5713.

[3] Alame, G., Brassart, L., 2020. Effect of topological defects on the elasticity of near-ideal polymer networks. Journal of Applied Mechanics 87, 121006.