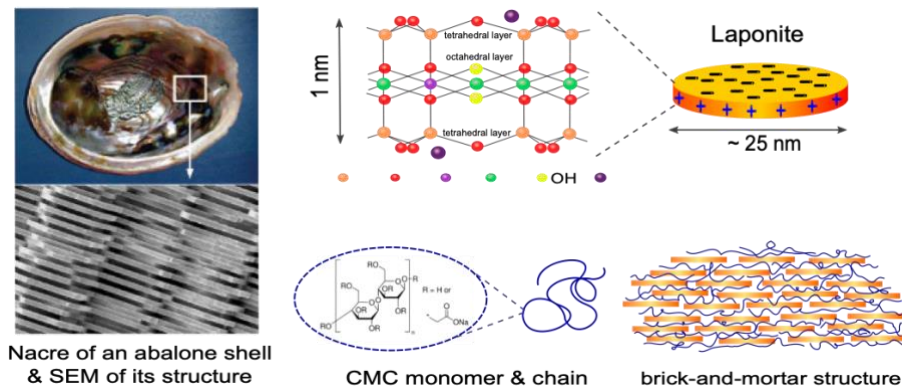


Nature-Inspired Sustainable Materials



Nacre of an abalone shell
& SEM of its structure

CMC monomer & chain

brick-and-mortar structure

Motivation

The growing environmental pollution of the world with synthetic, non-compostable plastics poses an ever-growing problem. Hence, it is desirable to replace these by natural polymers such as plant-based cellulose or alginate. However, they make no mechanically strong materials, which we need in packaging and coatings. Recently the Eiser group developed bioinspired, nanostructured composite materials with a microscopic architecture that resembles the brick-and-mortar structure of the mechanically tough, iridescent nacre in seashells as possible substitutes for synthetic polymers (Figure above) [1].

Your Project

We will explore the possibility to use different natural clays (2D-crystals; example is Laponite in the Figure above) and biopolymers to further develop such recyclable nanocomposite materials as transparent coatings. In particular, we want to integrate transparent active materials such as graphene or MOFs (Metal Organic Frameworks) rendering these smart plastic-replacements.

Requirements

Background in thermal & statistical physics would be advantageous. The applicant should be interested in experimental research, microscopy and scattering methods.

Other aspects

The experimental study will be supervised by the Prof. Eiser, an experienced Soft Matter Science researcher. Prof. D. Breiby and Prof. R.Cabriolu will collaborate with their groups in terms of x-ray scattering and simulation work, respectively.

Contact persons

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[1] P. Xu, T. Erdem, and E. Eiser, 'A simple approach to prepare self-assembled, nacre-inspired clay/polymer nanocomposites' *Soft Matter* **16**, 3385–3388 (2020)