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SEMINAR

Functional Protein-Based Materials from Opaquness to Transparency

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CIC biomaGUNE - Seminar Room

The fast-paced advancements in transparent materials have led to a significant demand for novel biocompatible materials that possess customized mechanical, functional, and high transparency attributes, suitable for various see-through biological applications.

Protein-based biomaterials are desirable for various functions due to their exceptional hierarchical and structural designs, inherent biocompatibility, diverse biological characteristics, and specific protein folding transitions in response to external stimuli. However, controlling the mechanical and microstructure of protein-based hydrogels has been challenging, as they depend on protein concentration, solubility, and stability. Increasing concentration can enhance toughness, but maximum solubility limits it. Protein engineering and DNA recombinant technologies have created new possibilities, but some new protein designs require high minimum gelation concentrations, restricting hydrogel synthesis and narrowing the mechanical behavior range. Additionally, most protein-based materials are opaque, and while several strategies have been proposed to form transparent protein-based hydrogels, the harsh synthesis processes can damage protein structure and functionality. Therefore, a thorough investigation is required to preserve the unique intrinsic properties of globular proteins in formulating functional, transparent protein-based materials.

In my presentation, I will discuss multiple techniques for creating protein-based hydrogels with adjustable mechanical behavior, microstructure morphology, and shape-morphing behavior. Additionally, I will introduce a straightforward approach that imparts exceptional properties to protein-based hydrogels compared to existing native and protein/polymer hydrogels. These properties include superior mechanical behavior, optical transmission, and shape-morphing behavior in a physiological-like environment.