Institute for
Nanoscale Physics and Chemistry

INPAC Lectures on Modern Trends in Nanoscience:

Designed Nano-scale Peptide-Cofactor Complexes for Functional BioMolecular Materials

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May 15 at 16h00

Coffee at 15:45

Celestijnenlaan 200F, Room 00.09

Abstract

Cofactors are molecules that confer function to many biological proteins. More stable, artificial proteins based on α-helical bundle motifs, can now be designed to incorporate synthetic non-biological cofactors with novel electronic and/or optical properties. Such cofactors possessing extended π-electron systems can now be designed and tailored, with appropriate donors, acceptors and constituents, to exhibit selected nonlinear optical responses and light-induced electron transport and/or proton translocation over large distances. The interior of the artificial protein scaffolding can be used to control the solubility, position, orientation, and indeed the properties of the cofactor within the peptide. An ensemble of such artificial proteins with these designed novel properties cannot form a material unless they can be ordered in one, two or three dimensions on macroscopic length scales. Gaining control over such intermolecular ordering would then result in a material whose macroscopic properties derive at a minimum from the incoherent superposition of the designed molecular properties of the ensemble, with the additional possibility of the ensemble generating coherent phenomena based on these properties. The exterior of the artificial protein scaffolding can be used to control the peptide's supramolecular assembly into sufficiently ordered nano-scale materials whose macroscopic behavior arises from such novel properties. In addition, the protein scaffold can be employed to control the degree of interaction or non-interaction between neighboring cofactors in the ordered nano-scale material.