Mimicking the Antenna System of Green Plants

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We report the preparation and investigation of hierarchically organized host-guest structures, presenting successive ordering from the molecular up to macroscopic scale, thus supporting the relationship between the molecular arrangements and the macroscopic properties. Size, shape and surface composition of the host which is zeolite L play a decisive role. Its base and coat have characteristically different chemical properties. The guests, organic dye molecules or complexes, are well oriented inside the channels and can be organized into distinctive patterns. Zeolite L crystals containing oriented fluorophores in their parallel nanochannels possess remarkable fluorescent properties and they can be arranged in nearly any desired manner by means of self-organization methods. This makes them ideal host-guest structures for the exploitation of energy transfer and energy funneling processes. Size, shape and surface composition of the objects but also the properties of the surface on which they should be organized play a decisive role.

We present a simple model of an artificial antenna based on supramolecular organization of dyes in nanochannels of the host, and we explain why zeolite L can be considered as an ideal host for this purpose. The preparation of different dye-zeolite L materials is described, and Förster energy transfer experiments carried out with them. Further, increasing supramolecular organization is discussed: the first unidirectional antenna system on a macroscopic level, organization of crystals and communication of the crystals interior with the environment. Additionally, we explain spectroscopy on monolayers of dye-zeolite L micro-crystals. The materials are shown to be new building blocks for optical, electro-optical and sensing devices.

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