Luminescent molecules and quantumsized particles in the cavities and channels of zeolites

Summary of the Research Plan

(A) Chemical, photochemical and spectroscopic properties (vibrational, electronic, time resolved) of dye molecules in the channels of zeolite L nano crystals with special emphases on sandwich structures.

Neutral organic dyes of appropriate shape are inserted typically from the gas phase into the channels of zeolite L micro/nano crystals. Cationic dyes are inserted by ion exchange. Topics: alignment of the dyes with respect to the c-axis, intrazeolite transport kinetics monitored by energy transfer, replacement kinetics of inserted dyes by small molecules, interactions with the host, influence of the cocations. Thin layers (monograin) are used where possible.

—*Vibrational spectroscopy* of the intercalated compounds (usually measured under HV conditions) are used for structural identification (normal coordinate analysis), as an analytical tool (e.g. quantitative anylysis of water content), for studying guest-host interactions and interactions between the intercalated molecules as a function of the loading.

— C*hemical reactivity* between the intercalated molecules, the guest-host reactivity and the reactivity of the guests with (small) molecules (e.g. oxygen) penetrating from the outside will be studied.

— The *electronic structure*, energy transfer and migration will be investigated by means of stationary and time resolved UV/VIS and luminescence spectroscopy, including optical microscopy techniques.

(B) Quantum sized Ag_2S (Cu_2S) in the cavities of zeolite A

The method developed by us to prepare the first luminescent quantum sized Ag_2S particles will be applied for preparing materials with different cocations, Ag_2S/AgX particles, and Cu_2S in the cavities of zeolite A, ZK-4 and zeolite L. X-ray and other methods will be used for structural identification.

— The *electronic structure* of these new materials will be investigated by means of stationary and time resolved UV/VIS and luminescence spectroscopy, including optical microscopy techniques.

— *Vibrational spectroscopy* of the material (typically HV conditions) are used for structural identification, as an analytical tool (e.g. quantitative analysis of water content), and for studying guest-host interactions and interactions between the intercalated molecules as a function of the loading.

— *The occurrence of intrazeolite charge transport* (ionic/electronic) via interacting quantum sized particles in the ground state and in electronically excited states under high vacuum conditions and/or in presence of a solvent are of special interest.

(C) Semiconductor/metal interfaces of quantum sized AgCl/Ag, Ag_2S/Ag, AgCl/Au

The electronic properties of particles consisting typically of 400 up to about 1000 atoms are analyzed with special emphases on the AgCl/Ag, Ag_2S/Ag and AgCl/Au semiconductor/metall interface (Schottky barrier, ohmic contact, potential barriers).

Key words: Supramolecular organization, luminescence, chemical reactivity, electronic structure,quantum sized, interfaces