



PROJECT "THEORY AND APPLICATIONS OF SINTER-CRYSTALLIZATION" DN 19/7

Sol-gel chemistry as a tool for the preparation of functional aerogel powders and composites

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Sol-chemistry is an efficient method for the preparation of porous glassy or nanocrystalline materials with tailored electrical, thermal or optical properties [1,2]. This work focuses on the dependence preparation conditions – structure – physical properties of hydrophobic silica aerogel granules, micro powders and composites all of them prepared under subcritical drying conditions with potential application as optical materials and insulation. The so prepared nanoporous hydrophobic silica materials are analyzed with scanning electron microscope, infrared spectroscopy, differential scanning calorimetry, thermal conductivity measurements and luminescence / excitation spectroscopy. It has been proved that a long solvent exchange times and surface hydrophobization lead to aerogel micropowders with a specific surface of about 900 m²/g and a bulk density of about 0.1 g/cm³. Attenuated total reflectance infrared (ATR-IR) spectroscopy in the region of the Si-O-Si and Si-OH vibrations is used for a description of the structural and chemical changes in aerogel powders, connected with their hydrophobization [3]. By using a two-step colloidal preparation scheme red or green emitting complexes, [Eu(phen)₂(NO₃)₃] or [Tb(phen)₂(NO₃)₃], are immobilized in silica aerogel granules, leading to a bright red or green luminescence upon 350 nm excitation [4].

References:

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