

Matjaž Koželj, PhD thesis, 2010

»Synthesis of substituted trialkoxysilanes and their use for preparation of materials via sol-gel route«

Abstract:

The preparation of novel materials possessing highly defined properties via sol-gel processing starts on a molecular level with the synthesis of silanes with a specific organic functionality, which is preserved to output material. In this dissertation are presented the syntheses of alkoxy silanes applying Barbier method (aryl silanes), hydrosilylation and esterification of chlorosilanes (3-bromopropylalkoxysilanes), reactions between 3-iso(thio)cyanatopropyl-trietoxysilane and amines yielded silylated corrosion inhibitors and UV absorbers, reactions between 3-halopropylalkoxysilanes and tertiary amines silylated ionic liquids. All compounds were spectroscopically characterized, with special care on ^{29}Si NMR spectroscopy.

Silanes offer innovative solutions for old and well known problems, so silanes were used for the preparation of coated pigments, which were subsequently used for the preparation of spectrally selective coatings, preparation of thin anticorrosion coatings on the spectrally selective surface Sunselect and for the preparation of polyhedral silsesquioxanes (PSS). All sol-gel processes were tracked with IR and ^{29}Si NMR spectroscopy. Polyhedral silsesquioxanes could be prepared with various catalysts. KF and KHF_2 represent a novel synthetic approach to PSS; they accelerate condensation and consequently the formation of polyhedral skeleton. Good yields are also achieved with strong organic bases like phosphazenes. Positive charged PSS could be prepared via hydrolysis of silylated ionic liquids or reactions between amines and octa(3-halopropyl)silsesquioxanes).

Keywords: alkoxy silanes, silylated ionic liquids, polyhedral silsesquioxanes, ^{29}Si NMR, sol-gel, coated pigments.