Spectroscopic Characterization of Polysiloxane and Bridged Polysilsesquioxane Xerogels

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Bridged polysilsesquioxanes are a class of hybrid organic-inorganic materials, formed by molecular building blocks. Such building units include an organic bridge o linking two or more Si atoms by hydrolytically stable Si–C bonds. It is possible to design these materials on a molecular level keeping control over their chemical and physical properties, including structure-adsorption characteristics by choosing the appropriate precursors in the reaction of hydrolytic polycondensation [1]. The possibility of introduction of the organic and inorganic groups into the structure of the final structure by co-condensation of different monomers is also an invaluable advantage of the sol-gel processing of organosilicas [2].

Amino-, thiol-, urea-, phenyl-, vinyl-, isocyano-, cyano- and acethoxy- functionalized polysilsesquioxane xerogels have been obtained by co-condensation of appropriate monomers: organobis(trialkoxysilanes) and trialkoxysilanes (Fig. 1). To investigate the influence of the organic bridge on the structural properties, the polysiloxane xerogels functionalized with the same groups were synthesized by co-condensation of tetraethoxysilane and appropriate trialkoxysilanes.

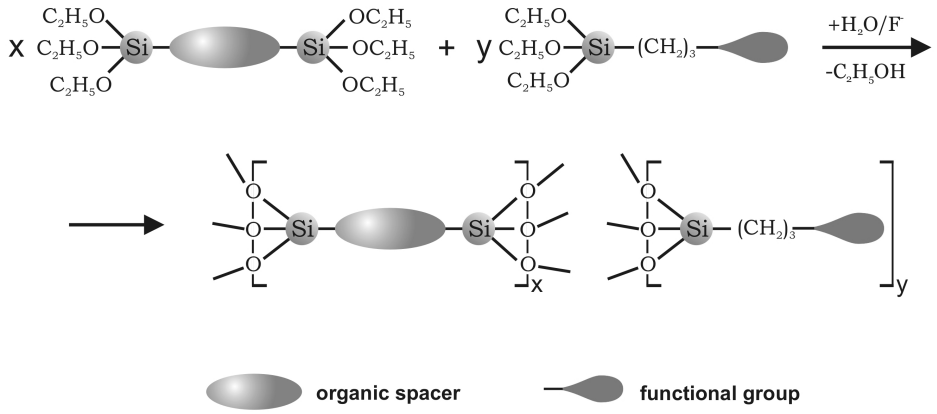

Fig. 1: Co-condensation of organobis(trialkoxysilane) and trialkoxysilane

The structure and composition of the final materials were investigated by several techniques: ^{13}C NMR, ^{29}Si NMR, FTIR and Raman spectroscopy, termogravimetry, elemental analysis, AFM and TEM microscopy and nitrogen adsorption measurements. All of techniques used to characterize the final materials proved to be efficient and complementary tools to determine a broad spectrum of properties of xerogels studied in the present work. The spectroscopic techniques used during the studies turned out to be particularly useful in the investigation of such complex hybrid structures [2].

[1] K.J. Shea, J. Moreau, D.A. Loy, R.J.P. Corriu, B. Boury, [in:] P. Gomez-Romero, C. Sanchez, Eds. "Functional Hybrid Materials", Wiley-VCH Verlag GmbH & Co. KGaA, Weinhem 2004.
[2] A. Dabrowski, M. Barczak, N.V. Stolyarchuk, I.V. Melnyk, Yu.L. Zub, *Adsorption* 11 (2005) 501.