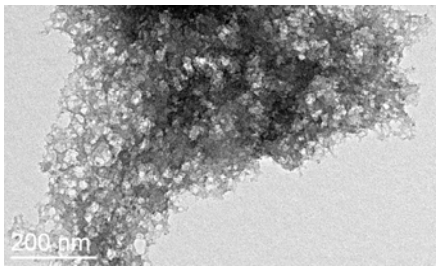
EMPA
Materials Science & Technology

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Master Thesis opening

Synthesis of aerogel based model catalysts for alcohol reforming

There is an opening for a Master Thesis in Switzerland under joint supervision by ETHZ Zurich and Empa for research on novel metal doped silica aerogel composite materials for catalysis applications.



Description

Aerogel materials are known for their outstanding combination of materials properties such as nanometer scale porosity, low density, high surface area and accessibility through a wide range of materials chemistries [1]. In particular silica aerogels have experienced an appreciable commercialization during the last decade. Although preferentially used for thermal insulation today, there is growing interest in these materials as high surface area support for chemical catalysis [2]. In this context, the elaboration of metal doped silica aerogels is an area of great interest. Preferred materials combine a classical silica aerogel material with a nanoscopic metal phase deposited on the inner surfaces. From a preparative standpoint, a simple “all-in-one” strategy is highly desirable; nevertheless the simplicity of the synthetic method must not be at the expense of its versatility and the accessible parameter space. The planned master thesis aims at further developing Cu-silica and Ni-silica aerogels staring from first successful model studies. The proposed methodology combines the use of functional ligand molecules covalently attached to a silica gel backbone for trapping metal ion precursors with direct alcohol reduction of the metal salts in an alcoholic pore fluid.

Engineering both the gel preparation and the alcohol reduction of the metal salts is expected to provide fundamental insight into growth mechanisms of nano-metal phases within nanoscopic pore environments. Preparative and characterization work will be complemented by catalytic studies on alcohol reforming reactions. The work is expected to lay the foundation for the development of next-generation aerogel based heterogeneous catalysts.

[1] M.A. Aegerter, N. Leventis, M. M. Koebel, “Aerogel Handbook”, Springer publishing (2011), **ISBN 978-1-4419-7477-8**

[2] A.J. Vizcaino, A. Carrero, J.A. Calles, J. A., Int. J. Hydr. Ener., (2005), **32(10-11)**, 1450-1461

Methodology

Sol-gel synthesis of silica gels doped with metal ions (Cu^{+2}, Ni^{+2}) will be performed at Empa to obtain materials with well-defined metal ion loadings. Wash out of the metal salts is avoided by the covalent attachment of ligand molecules on the silica backbone. Following the direct alcohol reduction of the metal salts, gels are dried supercritically and characterized. The most promising candidates will be tested in catalytic model studies (alcohol reforming).

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