22. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

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IN TEHNOLOGIJE, LJUBLJANA

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Legenda – Legend:
MM – Kovinski materiali/Metallic materials
CM – Kompozitni materiali/Composite materials
C – Keramika/Ceramic
P – Polimeri/Polymeric materials
MS – Modeliranje in simulacija procesov in tehnologij/Mathematical modeling and computer simulation of processes and technologies
HT – Toplotna obdelava in in eniring povr'in kovinskih materialov/Heat treatment and surface engineering of metals
CD – Korozija in degradacija materialov/Corrosion and degradation of materials
NN – Nanoznanost in nanotehnologije/Nanosciences and nanotechnologies

YR Mladi raziskovalci – Young scientists

CATALYTIC AND SENSOR PROPERTIES OF Co_3O_4 PREPARED BY COMBUSTION SYNTHESIS ROUTE

Katarina Vojisavljević[1], Susanne Wicker[2], Nicolae Barsan[2], Brigita Kmet[1], Silvo Drnovšek[1], Barbara Malič[1]
[1]Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia
[2]Eberhard Karls University of Tübingen, Auf der Morgenstelle 15, 72076 Tübingen, Germany
E-mail: katarina.vojisavljevic@ijs.si

Cobalt oxide, Co_3O_4, has shown great potentials for various practical applications due to excellent electronic, magnetic and redox properties. Its high catalytic activity in combustion of CO is well known for a longer period. However, this material has also drawn some research interest as a p-type metal oxide gas sensor. A powerful strategy to improve both catalytic and sensor performance is the utilization of a nanocrystalline powder with a high surface to volume ratio. Thus, a strong interaction between the surrounding gas and the material is enabled.

The nanocrystalline Co_3O_4 powder was synthesised by the nitrate-glycine combustion route. The glycine/metal ion ratio was adjusted to provide stoichiometric or fuel-lean conditions of the redox reaction. The auto-ignition of gels with the evolution of large amounts of gases was occurred at approximately 180 °C, and the process was spontaneously underwent to a smouldering combustion and formation of a voluminous powder. According to the X-ray diffraction analysis the phase-pure Co_3O_4 was obtained only when the precursor powder was prepared from the 50% fuel-lean redox reaction. The field emission scanning electron micrographs revealed the spongy aspect of the calcined powder, where small primary particles formed the agglomerates.

For the screen-printing, the Co_3O_4 powder was mixed with the organic binder to achieve a viscous paste suitable for printing. The paste was screen printed onto Al_2O_3 substrates with interdigitated Pt electrodes for read-out of the resistance and a Pt heater for operation at well controlled temperatures, and fired at 400 °C in air. The catalytic conversion of the Co_3O_4 powder and the sensor signal of the corresponding sensors were checked under different concentrations of the reducing test gases. The excellent catalytic activity of the Co_3O_4 powder was confirmed. The sensor signal was the best to ethanol at the operating temperature of 150 °C, which was found to be 100 °C lower than for comercial SnO_2 sensors.