The Serbian Society for Ceramic Materials
Institute for Multidisciplinary Research (IMSI), University of Belgrade
Institute of Physics, University of Belgrade
Center of Excellence for the Synthesis, Processing and Characterization of Materials for use in Extreme Conditions "CEXTREME LAB" - Institute of Nuclear Sciences "Vinča", University of Belgrade
Faculty of Mechanical Engineering, University of Belgrade
Center for Green Technologies, Institute for Multidisciplinary Research, University of Belgrade
Faculty of Technology and Metallurgy, University of Belgrade
Faculty of Technology, University of Novi Sad

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Branko Matović
Zorica Branković
Aleksandra Dapčević
Vladimir V. Srdić

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June 11-13, 2019
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5CSCS-2019

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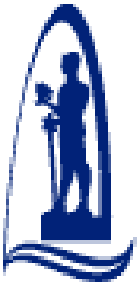

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COMPARISON OF SENSING PROPERTIES OF SnO_2/KIT-5 AND SnO_2 HUMIDITY SENSORS

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In this work, two different syntheses approaches – nanocasting and sol-gel technique were employed for the preparation of SnO_2 powders for humidity sensors. Stock solution of $SnCl_2$ in ethanol (0.5 M) was used as a Sn-precursor for both syntheses.

In the first procedure, this solution was infiltrated by wet impregnation method into the hydrothermally prepared KIT-5 used as silica template. Mesoporous SnO_2/KIT-5 hybrid was obtained after two step loading/calcination process. Calcination was performed at 550 °C for 5 h. In the second procedure, silica template was excluded from synthetic path. Ethanol solution of $SnCl_2$ was slowly heated to form the gel which was later submitted to the same calcination conditions resulting in the preparation of SnO_2 nanopowder.

By dispersing the as prepared powders in the ethyl-cellulose/α-terpineol solution and adding a few drops of acetic acid in the mixture, viscous pastes were prepared and further homogenized for 24 h with magnetic stirrer. Using doctor blade applicator a few micron thick films were deposited onto alumina substrates provided with interdigitated Pt/Ag electrodes.

Sensors' characteristics were compared by measuring the change of the complex impedance of the samples exposed to a humid climate chamber environment at different temperatures and RH values from 40 % to 90 % at 25 °C and from 30 % to 90 % at 50 °C. The value of impedance measured at 42 Hz and within the RH range of 40 % to 90 %, changes 53 times at 25 °C, and 96 times at 50 °C. In contrast, for the sensor prepared from chemically derived SnO_2, the impedance changes in a moderate way – 8 times at 25 °C and 3 times at 50 °C. Fast response/recovery time of the SnO_2/KIT-5 hybrid sensor exposed to humidity change from 40 % – 90 % at room temperature, confirmed superior potentials of this material for humidity sensing over the SnO_2.