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TERASA, Maik-Ivo 1

SIEBERT, Leonard 1

ABABII, Nicolai 2

LUPAN, Oleg 1 2

ADELUNG, Rainer 1

1. Functional Nanomaterials, Faculty of Engineering Institute for Materials Science, Kiel University, Kiel, Germany
2. Department of Microelectronics and Biomedical Engineering Center for Nanotechnology and Nanosensors, Technical University of Moldova, Chisinau, Republic of Moldova

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3D-Printed Sensor Array of Semiconducting Oxides

Abstract

Sensors start to play an ever increasing role in human life and new technologies for their cost-effective mass production are required. In this work, the one-step 3D-printing of nanoflakes—nanowire covered Fe₂O₃/Fe–CuO/Cu₂O/Cu microparticles (MPs) with diameters of ~10 μm on the surface of glass substrate successfully forming an ordered net is reported for the first time. 3D-printed Fe–Cu and only Cu MPs-based stripes formed non-planar CuO/Cu₂O/Cu and Fe₂O₃/Fe–CuO/Cu₂O/Cu heterojunctions after thermal annealing at 425 °C for 4 h in air and were fully covered with

nanoflakes of Fe₂O₃ and CuO nanowire net bridging MPs with external Au-contacts. The morphological, chemical and structural investigations were performed in detail, showing the high crystallinity of the 3D printed material. This concept proves to be easily translatable to other semiconducting, metallic or functional microparticles for the rapid fabrication of sensor devices.