Synthesis, Structure, Properties and Applications of Oxide-Based Nanostructures and Nanotubes

Cengiz Kaya (Yıldız Technical University, Department of Metallurgical and Materials Engineering, Davutpasa Campus, Istanbul)

Nano-sized metal oxides with controlled morphology, structure and size have gained significant technological and scientific interest because of their unique optical, electronic, physical and chemical properties that are neither characteristics of the individual atoms nor of the bulk counterparts due to the large surface area to volume ratio of nano-structures. Although recently, one-dimensional (1D) nanostructures, such as wires, belts, rods, ribbons, cubes, dandelions and tubes have been a subject of extensive research because of their potential applications in various fields, the remaining question is how to obtain such structures using cost-effective and reliable synthesis techniques. Therefore in the present work, various nanostructures in the form of powder, plate, flower, rod or nanotubes were synthesised by low temperature hydrothermal processing. Ag-TiO2, TiO2, CuO, FeO, ZnO, Cu-Zn nanostructures with sizes smaller than 100 nm were obtained and characterised for many different applications including biomedical and antimicrobial field as well as engineering applications. First time to date multi-walled CuO nanotubes (NTs) were prepared by a simple hydrothermal method followed by a low temperature thermal oxidation process without the use of any catalysts, surfactants or substrates. Pure multi-walled CuO NTs were obtained after hydrothermal treatment at 100°C followed by a calcination process at 400°C. It was shown that the obtained multi-walled CuO NTs with high purity and crystallinity had 3 nm inner and 7 nm outer diameters and showed a strong antibacterial effect against S. aureus bacteria. The results of other nanostructures including titania and ZnO nanotubes will also be presented in the presentation.

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