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Flame based growth of ZnO nano- and microstructures for advanced optical, multifunctional devices, and biomedical applications (Conference Presentation)

Yogendra K. Mishra, Jorit Gröttrup, Daria Smazna, Iris Hölken, Mathias Hoppe, Sindushree Sindushree, Sören Kaps, Oleg Lupan, Jan Seidel, Teresa Monteiro, Ion M. Tiginyanu, Lorenz Kienle, Carsten Ronning, Karl Schulte, Bodo Fiedler, Rainer Adelung

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Abstract

The recent flame based growth strategy offers a simple and versatile fabrication of various (one, two, and three-dimensional) nano- and microstructures from different metal oxides (ZnO, SnO_2, Fe_2O_3, etc.) in a desired manner.[1] ZnO structures ranging from nanoscales wires to macroscopic and highly porous 3D interconnected tetrapod networks have been successfully synthesized, characterized and utilized for various applications. The ZnO micro- and nanoneedles grown at walls in silicon trenches showed excellent whispering gallery mode resonances and photocatalytic properties.[2] Using the same strategy, large polycrystalline micro- and nanostructured ZnO platelets can be grown with grains interconnected together via grain boundaries and these grain boundaries exhibit a higher conductivity as compared to individual grains.[3] This flame transport synthesis (FTS) approach offers the growth of a large amount of ZnO tetrapods which have shown interesting applications because of their 3D spatial shape and micro-and nanoscale size, for example, interconnected tetrapods based devices for UV-detection and gas sensing.[4-5] Because of their complex 3D shape, ZnO tetrapods can be used as efficient filler particles for designing self-reporting,[6] and other interesting composites. The nanostructured materials exhibit an important role with respect to advanced

biomedical applications as grown ZnO structures have shown strong potentials for antiviral applications.[7] Being mechanically strong and micro-and nanoscale in dimensions, these ZnO tetrapods can be easily doped with other elements or hybridized with various nanoparticles in form of hybrid ZnO tetrapods which are suitable for various multifunctional applications, for example, these hybrid tetrapods showed improved gas sensing properties.[8] The sacrificial nature of ZnO allows the for growth of new tetrapods and 3D network materials for various advanced applications, for example, highly porous and ultra light carbon based Aerographite materials[9] and hollow silicon tetrapods.[10] These carbon based highly porous network can be further utilized for growth of new hybrid 3D nanomaterials, for example, Aerographite- GaN[11] and Aerographite-ZnO[12] for advanced optical and other applications.