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Low temperature VLS synthesis of silicon oxide nanowires using from free jet, activated by electron beam plasma

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Silicon based nanostructures represent a promising choice for a wide variety of applications ranging from solar energy conversion, light-emitting devices to biological sensors. In particular, silicon oxide SiOx (x≤2) nanowires have diverse and flexible morphology, good biocompatibility, a low refractive index, and intense photoluminescence at room temperature, and are compatible with conventional semiconductor technology. The surface of these nanostructures can be easily modified and functionalized. Functionalized silicon oxide nanowires are used to control surface wettability, which is important for biological applications and for the enhancement of boiling heat transfer on nanostructured surfaces Silicon oxide nanowires SiOx were synthesized by the gas-jet electron beam plasma chemical vapor deposition (GJ EBP CVD) method. The synthesis of nanostructures was carried out on silicon substrates with thin tin or indium film as a catalyst. In particular, aligned arrays of nanowire bundles (microropes) were synthesized from a mixture of monosilane and hydrogen (argon) [1]. The morphology of the nanostructures was investigated by transmission and scanning electron microscopy, their composition by X-ray energy dispersive spectroscopy and optical properties by photoluminescence spectroscopy. The synthesis was carried out using the well-known vapor–liquid–solid (VLS) mechanism. A model is proposed for the synthesis of the nanostructures by the GJ EBP CVD method, including the formation of aligned bundles of nanowires (microropes) due to nonuniform heating of the catalyst particle by directed plasma flow. The obtained nanostructures have intense photoluminescence in the visible region of the spectrum at room temperature. [1] E. Baranov, A. Zamchiy, and S. Khmel, Tech. Phys. Lett. 39 (2013)1023

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