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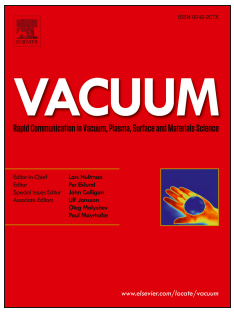

Tin-catalyzed oriented array of microropes of silicon oxide nanowires synthesized on different substrates

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Tin-catalyzed oriented array of microropes of silicon oxide nanowires synthesized on different substrates

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Abstract

Silicon oxide (SiO_x) nanowires were synthesized from a monosilane–argon–hydrogen mixture on substrates of different materials (monocrystalline silicon (c-Si), glass, stainless steel, copper, and copper with a SiO_2 barrier layer) coated with a tin catalyst film 60 nm thick using the gas-jet electron beam plasma chemical vapor deposition (GJ EBP CVD) method. High-density oriented arrays of microropes of SiO_x nanowires were obtained on c-Si and glass substrates and a copper substrate with a SiO_2 barrier layer. The fabrication of the nanowires included three steps: heating the substrate with the tin catalyst film, hydrogen plasma treatment of it, and synthesis of the structures. Heating and hydrogen plasma treatment of the tin catalyst on c-Si and glass substrates leads to a decrease in the wetting of the substrate material by tin. As a result, the morphology of the tin catalyst particles changes from semi-elliptical to truncated spherical, which leads to a significant decrease in their surface density as a result of coalescence. A condition for obtaining a high-density oriented array of microropes of SiO_x nanowires by the GJ EBP CVD method using a tin catalyst is the absence of chemical reaction between tin and the substrate material.

Keywords chemical vapor deposition, electron beam plasma**,** silicon oxide nanowires, tin catalyst, vapor-liquid-solid mechanism