Field-emission characteristics of density-controlled SiC nanowires

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β-Silicon carbide (SiC) nanowires with a wide band-gap of 2.3 eV have shown excellent field emission properties due to their superior electronic, physical and chemical properties. SiC nanowires were grown directly on Si substrates by thermal evaporation of WO3 and graphite powders at high temperature using NiO catalyst. The densities of the nanowires were controlled by varying the NiO catalyst concentration. The morphology, structure and composition of the nanowires were characterized by SEM, XRD, Raman, FTIR, TEM and EDX measurements. The synthesized nanowires were single crystalline β-SiC oriented along the [111] direction. Field emission measurements showed that the emission efficiency was strongly dependent on the density of SiC nanowires. Lowest turn-on field of 1.8 V/μm and highest field enhancement factor of 5.9 x 103 was observed for the medium density SiC nanowire sample. The reasonably high field enhancement factor, emission stability and uniform emission sites suggest that the SiC nanowires with medium density could be an effective and reliable electron-emitting source for many practical applications.