

Preparation of Catalytic Nanoparticles in Mesoporous Silica Film for Oriented Growth of Single-Walled Carbon Nanotubes

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Vertically oriented single-walled carbon nanotubes (SWNTs) would be an ideal field electron emitter that can realize lower threshold voltage and higher electric current than microtips of Si or metals. In this study, we aimed that SWNTs are vertically oriented using mesoporous silica (cubic) film as a guide of SWNTs growth. For this vertical orientation, catalysts for SWNTs must be placed between the mesoporous silica film and the substrate. Three kinds of catalysts loading methods were examined. The first one is the impregnation method; the calcined mesoporous silica film was immersed in the catalytic solution. The second one is the incorporation method; mesoporous silica film was prepared using Fe-doped silica sol solution. The third one is the sputtering method; the mesoporous silica film was coated on cobalt film deposited by sputtering deposition. We concluded that the sputtering method can realize the vertical growth of SWNTs from the bottom of the mesopores.