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CVD Synthesis of Single-Walled Carbon Nanotubes from Alcohol

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Developments of catalytic CVD generation of single-walled carbon nanotubes (SWNTs) by using alcohol as the carbon source will be presented. High-purity SWNTs can be generated at relatively low CVD temperatures from metal catalytic particles supported on zeolite or directly dispersed on flat substrates such as meso-porous silica, quartz and silicon. The zeolite support is used for bulk generation and direct growth as film on substrates is useful for optical or semi-conductor applications. By use of the ethanol, the CVD apparatus can be very simple; the cold-wall CVD with in-situ Raman observation is demonstrated. Recently, the vertically aligned SWNTs mat with a couple of micron meters is grown on quartz substrates by employing the most efficient activation of catalytic metals. On the other hand, the chirality distribution of SWNTs determined by the near infrared fluorescence is quite unique for low-temperature CVD condition. The near armchair nanotubes are predominantly generated probably because of the stability of nanotube cap structure for thin nanotubes. The growth process of SWNTs simulated by molecular dynamics method gives an important suggestion about this chirality-selective generation of SWNTs. Perspective of chirality-selective and morphology-controlled CVD growth will be discussed.