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system exhibits polydispersity and forms larger particles (~ 7 nm) with high defect density to enable penetration of Se atoms deep inside the CdSe core. In the CdSe-3:1 system, the polydispersity is decreased, and we find evidence of the extra Cd-capping layer on CdSe core. A model of the nanoparticles formed by the different routes and the effect of oxidation on its properties are modeled, based on the observation by several complementary techniques.

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Coaxial Nanocable Arrays: Si Sheathed With Diamond-like Carbon

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In the past years, silicon nanowires have attracted considerable attention due to their potential applications in interconnects and basic components in future nanoelectronic and especially optoelectronic devices [1,2]. Major efforts have been made to systematically synthesize and assemble silicon nanowires as well as to elucidate the structures and mechanism. In general, semiconductor nanowires need to have an inorganic passivation layer because an unprotected surface may alter their optical and electrical properties [3]. However, a significant bottleneck in the field is the lack of a general approach to the synthesis of nanowire building blocks composed of complex functional materials. Here we report a versatile approach for the synthesis of composite silicon nanowire structures with diamond-like carbon (DLC) sheaths acting as inorganic passivation layers using plasma technology in which the compositional limitation is no longer an issue

Si nanowires as cores were prepared using electroless metal deposition, which can be understood on the basis of the self-assembled localized microscopic electrochemical cell model [4]. These fresh Si nanowires were then coated with DLC using acetylene plasma deposition at room temperature [see Fig. 1(a)]. The Raman spectrum acquired from the composite Si nanostructures is shown in Fig. 1(b). According to the integrated intensity ratio of Si (1st order) and carbon (G-band), the thickness of the DLC coating layer is calculated to be less than 50 nm. To give direct experimental proof for the formation of Si nanowires sheathed with thin DLC films, we conducted TEM on the samples. Figure 2(a) shows a Si nanowire covered by a thin DLC film. It can be seen that the thickness of the DLC layer is approximately 30 nm, which is in good agreement with the Raman results. The corresponding selected area diffraction pattern shown in Fig. 2(b) indicates that the composite Si nanowire structure has a crystalline core and a surrounding amorphous layer. Room-temperature visible photoluminescence (PL) was also observed from the as-prepared composite nanostructures [see Fig. 3]. Spectral analyses suggest that the visible PL band arises from sp^2 hybridized carbon clusters with different sizes in the diamond-like carbon layers.

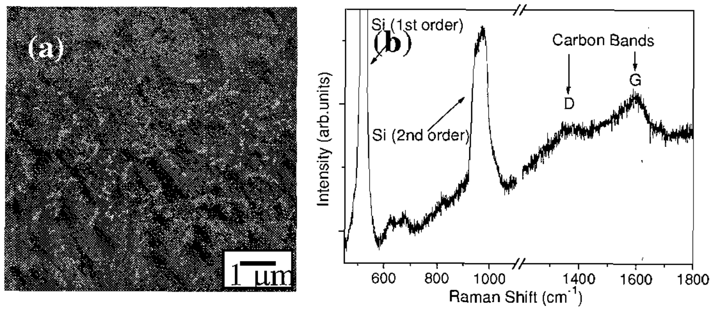

Figure 1. (a) SEM image of dense oriented Si nanowires with DLC sheaths. (b) Raman spectrum obtained from the composite Si nanostructure.

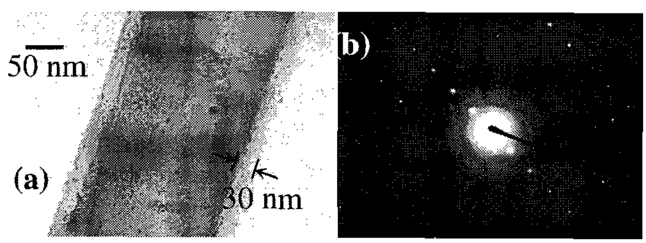

Figure 2. (a) TEM image of a composite Si nanowire. (b) The selected area diffraction pattern of the composite nanowire shown in Fig. 2(a).

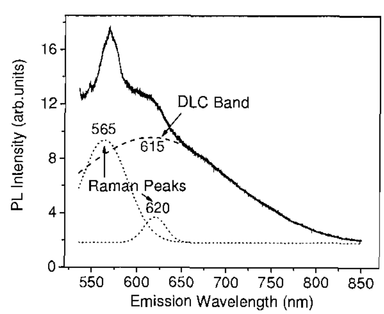

Figure 3. PL spectrum of the Si nanowires with DLC sheaths, taken under excitation with the 488 nm line of an Ar^+ laser.

Keywords: nanocable arrays; plasma deposition; diamond-like carbon.

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