Synthesis of phase-separating stainless alloy filled carbon nanotube by liquid and solid interfacial decomposition method

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Carbon nanotube (CNT) is known to be filled with various metal materials into its hollow cavity. Only a few reports of phase-separating alloy filled CNT are published [1]. So in this study, we report synthesis of new type of metal structure filled CNTs which are filled with austenitic stainless (iron 72%, nickel 8%, chrome 18%, others 2%) alloy having separation of phases. The experimental method was employed liquid and solid interfacial decomposition method [2, 3]. Figure 1 shows that transmission electron microscope (TEM) image of typical phase-separating stainless alloy filled CNT and nano-beam electron diffraction (NBED) patterns of three parts (from A to C in TEM image) of the CNT. The structure of the synthesized CNT possesses 3 phases which indicate that monocrystal of Fe$_2$(1-x)Cr$_2$xO$_3$ in A part, polycrystal of Fe$_2$(1-x)Cr$_2$xO$_3$ in B part and monocrystal of Fe$_{1-x}$Cr$_x$ in C part by NBED analyses.


Figure 1 TEM image of phase-separating stainless alloy filled CNT and NBED patterns. Inserted image is high magnification TEM image in red square (scale bar is 5nm).