Highly separated semiconducting carbon nanotube (99.9%) thin-film transistor using printing technology

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The single-walled carbon nanotube (SWNT) thin-film transistors (TFTs) have many exceptional electronic properties in terms of its suitability for display driving circuit due to the high on-currents and mobility, which is greater than those of alternative channel materials [1]. Furthermore, SWNTs are flexible materials, and their solution is compatible with printed electronics [2]. However, there still remains a problem regarding the parasitic current paths stemming from metallic SWNTs [3]. Thus, in this work we demonstrate highly seperated SWNT TFT through the printing technology with 99.9% semiconducting SWNT solution [4]. The fabricated SWNT TFTs show the significant enhancement in device performance with a 100% yield. For more accurate extraction of the mobility in the fabricated SWNT TFTs, we newly develop the capacitance-voltage technique, which is not dependent on uncertain density and quantum capacitance of SWNT network films.

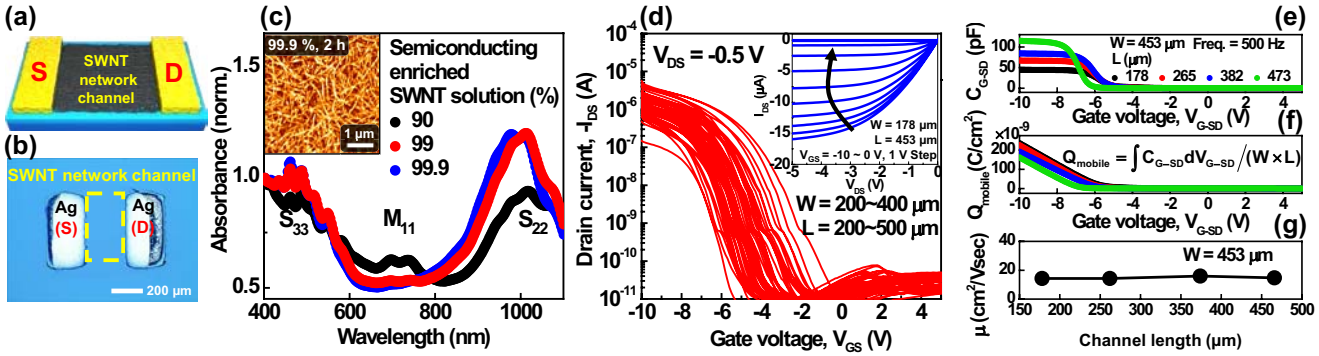

Fig. 1. A schematic illustration (a) and a microscope image (b) of the printed SWNT TFT. (c) UV-vis-NIR absorption spectra. (Inset) AFM image of the SWNT network film. (d) Transfer characteristics (I_{DS}-V_{GS}) of the fabricated SWNT TFTs with widths of 200-400 μm and lengths of 200-500 μm. (Inset) Output characteristics of the SWNT TFT. (e) Capacitance-voltage characteristics. (f) Extracted Q_{mobile} based on the gate voltages. (g) Extracted mobility by the proposed method.

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