



DISPERSION STATE OF SWCNT: FROM DILUTED TO CONCENTRATED SWCNT INKS

Dragana Stevic^{1*}, Radovan Kukobat¹, Katsumi Kaneko¹

¹*Research Initiative for Supra-Materials, Shinshu University, Nagano 380-8553, Japan*

*Presenting author's e-mail: dragana.stevic05@gmail.com

Introduction

SWCNT inks are attractive for fabricating electrodes such as free-standing electrodes and transparent electrodes. Diluted SWCNT inks have water like viscosity and can be prepared by ultrasonication treatment in presence of surfactants.¹ On the other hand, preparing concentrated SWCNT inks which have viscosity > 0.4 Pa·s is not straightforward because the ultrasounds do not penetrate uniformly through the dispersion system and the SWCNTs are barely dispersed. Here, we show the preparation routs for concentrated and diluted SWCNT inks and examine dispersion stability of these SWCNT inks.

Materials and Methods

The SWCNTs (MEIJO eDIPS) were dispersed with sol-gel Zn/Al complex dispersant² at the SWCNT : Zn/Al ratio of 1:10. Ultrasonication (Homogenizer tip SONIC) and three roll-mill treatment (AIMEX BR 100 VIII) dispersed SWCNTs in aqueous media. Viscosity of SWCNT inks was measured with rotational viscometer (RION, VT 06). Bundle size was counted from the micrographs recorded with Scanning Electron Microscope (SEM, JEOL, JSM 7000F).

Results and Discussion

Concentration of SWCNT inks governs viscosity of the inks in the dispersion system. The SWCNT inks of < 0.1 wt.% SWCNTs have viscosity < 0.4 Pa·s and show liquid like consistency (Figure 1a). The SWCNT inks of > 0.1 wt. % have viscosity > 0.4 Pa·s and have paste like consistency (Figure 1b). We dispersed up to 1 wt.% of SWCNTs in aqueous dispersion system and viscosity increased to 16 Pa·s. The SWCNTs have bundle size of 20 nm and length of tens of microns and are entangled into the gelly structure of SWCNT inks according to the SEM observation. Entangled structure of long SWCNTs contributes to the increase in viscosity of SWCNTs inks.

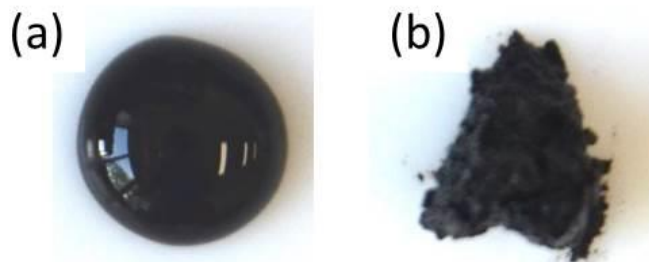


Figure 1. The SWCNT inks. (a) 0.1 wt.% SWCNT ink. (b) 1 wt.% SWCNT ink.



Conclusions

We prepared highly concentrated SWCNT inks which have paste like consistency and should be promising for fabricating conducting materials of SWCNTs.

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References

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