SINGLE-WALLED CARBON NANOTUBE REINFORCED COPPER MATRIX NANOCOMPOSITES

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Carbon nanotubes (CNTs) have excellent properties for improving mechanical, thermal, and electrical characteristics of nanocomposites as reinforcement materials [1]. In order to develop successful CNT-reinforced nanocomposites, it is important to transfer the extraordinary properties of CNTs to the matrix [1]. Two main issues are homogeneous distribution and high interfacial strength[1].

We have studied CNT reinforced copper matrix nanocomposites[2]. In this study, CNT was dispersed by the mechanical mixing process and interfacial strength between the nanotubes and the copper matrix was controlled by coating the nanotubes with nickel. Figure 1 shows nickel-coated nanotubes. The thickness of the nickel layer on nanotubes ranged between 60 and 170 nm. The sintering process was adapted for the fabrication of nanocomposites specimens. The displacement characteristics of nanocomposites at an elevated temperature were investigated by a small punch (SP) creep tester to evaluate the interfacial strength between copper particles and CNTs. Figure 2 shows displacement-time curves of the nanocomposites. Compared with the pure copper specimen or the nanotube reinforced copper matrix composite, the nickel-coated nanotube reinforced copper matrix composite was found to exhibit the significantly improved displacement rate. A pure copper specimen was used as a reference material. For the nanotube reinforced opper matrix composite (0.5 vol %), the displacement rate rapidly increased and the rupture time was shorter than that of the pure copper specimen. This might be due to the poor interfacial strength between carbon and copper [2, 3]. The nickel-coated nanotube reinforced copper matrix composite showed the longest rupture time which is six times longer than that of the pure copper specimen. Probably due to the increased interfacial bonding [2]. The electrical and thermal characteristics of the nanocomposites were also investigated.

References:

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[2] Byengsoo Lim, Chul-ju Kim, Bumjoon Kim, Untae Shim, Seyoung Oh, Byung-ho Sung, Jee-hoon Choi and Seunghyun Baik, nanotechnology, 17(2006) 5759-5764
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Figures:

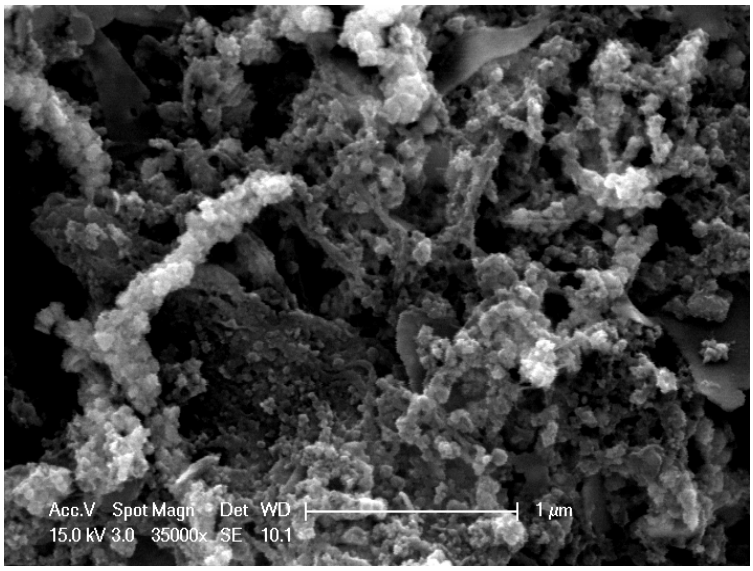

Figure 1. Nickel –coated carbon nanotubes. [2]

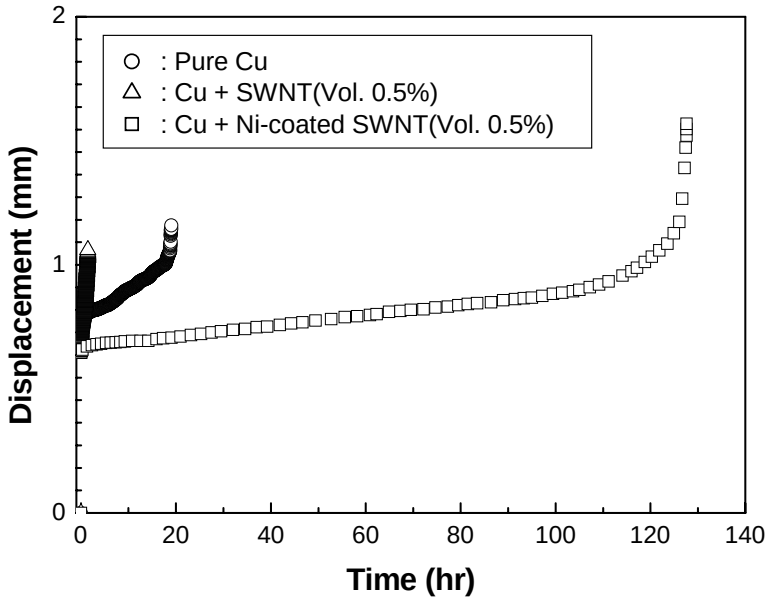

Figure 2. The effects of interfacial strength on displacement rates. [2]