UNIFORM SURFACE DECORATION AND INTERFACIAL BONDING OF ALUMINA PARTICLES ON CARBON NANOTUBES BY MICROWAVE TREATMENT

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Abstract

In this research, we uniformly coated Al_2O_3 on multi-welled carbon nanotubes, and by incorporating a microwave treatment step, have increased the interfacial strength between Al_2O_3 and carbon nanotubes via formation of an Al_2OC intermediate.

We use the PAA(poly acrtlic acid) as a surfactant and dispersion agent for uniform Al coating. Carbon nanotubes were dispersed in distilled water using PAA, while $Al(acac)_3$ was also added as an Al+3 ion precursor. Microwave treatment was used to selectively heat the carbon nanotubes to generate Al_2O_3 and Al_2OC by thermal decomposition

SEM and TEM results demonstrate that Al_2O_3 were uniformly coated on carbon nanotube. Thermogravimetric analysis is utilized to measure the quantity of Al_2O_3 produced. Results show a 5 wt% increase for each addition of 1 g of $Al(acac)_3$ with 1.5 g of fixed CNT quantity. X-ray results indicate the presence of Al_2OC. By increasing microwave treatment time, we found that the Al_2OC peak increased in intensity. This indicates that microwave treatment significantly contributes to Al_2OC forming. Further, X-ray photoelectron spectroscopy was used to analyze chemical binding, and confirms that Al is covalently bonded to carbon and oxygen. We expect that this covalent bonding is a result of the interfacial reaction between Al_2O_3 and carbon nanotubes.

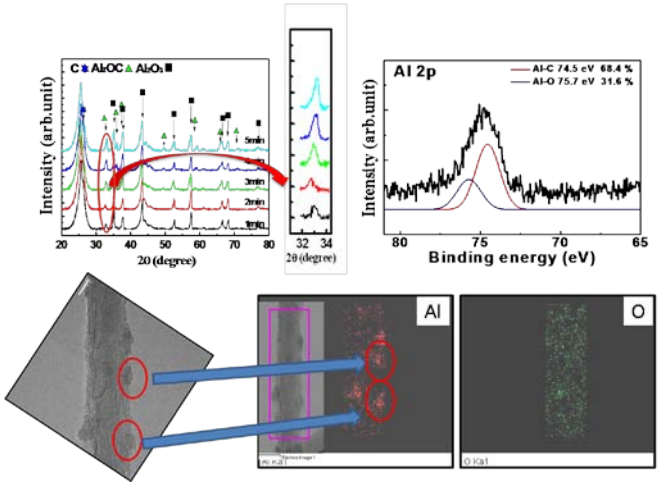

Fig 1. X-ray diffraction result show Al_2O_3 and Al_2OC were successfully formed(left-top) and X-ray photoelectron spectroscopy result clearly show the Al-C covalent bond(right-top). Transmittance electron microscopy(left-bottom) and elements mapping(right-bottom) observe the uniform decoration of Al_2O_3 nanoparticles on carbon nanotube surface.