

Evaluation of Purity and Thermal Resistance of CNT by Thermogravimetry

Carbon nanotubes (CNT) are expected to have wide application as a material that supports nanotechnology. A typical thermal analysis technique, Thermogravimetric (TG) measurement, was used to compare and evaluate the purity and thermal resistance of CNT in this Application News.

When CNT is heated to combustion in air, a decrease in mass occurs. After burning, the purity can be determined from the weight loss, as the metallic particles, etc. used as a catalyst remain intact. Moreover, the thermal resistance can be evaluated based on the temperature at which the weight loss occurred, and differential quantitation can be conducted with respect to amorphous carbon. The TGA-50 thermogravimetric analyzer is a single-function, vibration-resistant thermogravimetric instrument equipped with a high-sensitivity suspension-type balance to provide highly stable measurement of samples, even in the sub-1 mg range.

In addition, the Simultaneous TG-DTA DTG-60 is used to conduct thermogravimetric and differential thermal analysis concurrently.



Fig.1 DTG-60



Fig.2 TGA-50

■ Measurement of CNT (SWNT) Using the DTG-60

The DTG-60 (top-loading type) is an instrument which can perform differential thermal analysis (DTA) simultaneously with thermogravimetry. Fig.3 shows the results of measuring SWNT (single-wall carbon nanotubes) by the arc discharge method.

Using TG, a small decrease in weight is seen from about 500 °C due to combustion of the CNT (SWNT). In the DTA curve, an exothermic peak is seen at 682.7 °C due to combustion of the CNT (SWNT), however, an exothermic peak is also seen at the lower temperature of 322 °C. This is thought to be due to the combustion of amorphous carbon.

From the two-step weight loss percent corresponding to the two DTA peaks, the ratio of amorphous carbon to CNT (SWNT) can be obtained.

Sample provided by Ando Research Laboratory, Meijo University.

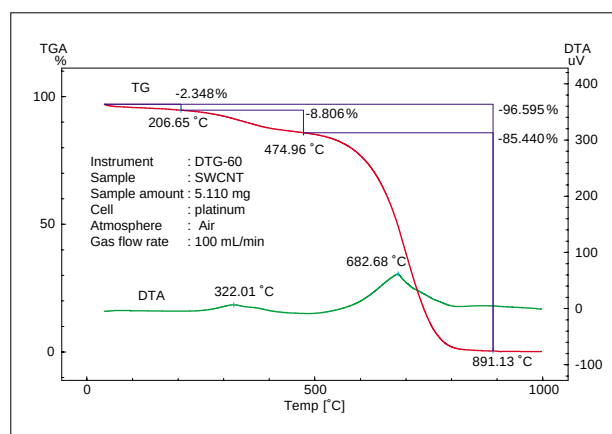


Fig.3 TG/DTA Measurement of SWNT by Arc Discharge

■ Measurement of CNT Using the TGA-50

The TGA-50 (suspension type) is a thermogravimetric analyzer featuring high sensitivity. Fig.4 shows the CNT measurement results obtained using the HiPco method. Good reproducibility was obtained in the results of two repeat measurements, even using sample weights less than 0.5 mg, indicating that the TGA-50 is effective in the thermogravimetric measurement of trace amounts of CNT.

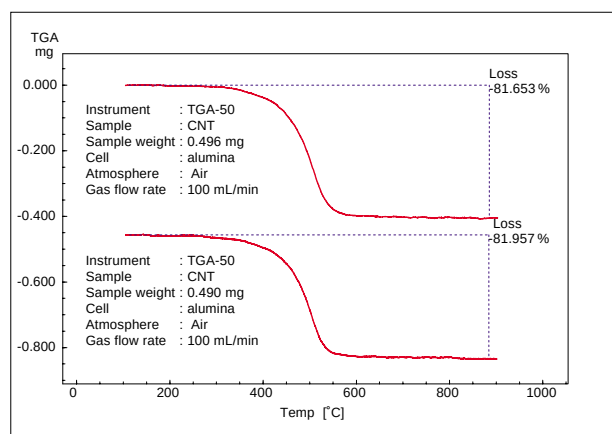


Fig.4 TG Analysis of Trace CNT (about 0.5 mg)

NOTES:

*This Application News has been produced and edited using information that was available when the data was acquired for each article. This Application News is subject to revision without prior notice.



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