

Laser vaporization clusters from metal loaded graphite used for SWNT generation

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In order to study the generation mechanism of SWNTs, we have studied metal-carbon binary clusters generated by the laser vaporization of Ni/Co and Ni/Y doped graphite materials used for macroscopic production of SWNTs.

Fig.1 shows positive and negative cluster ions from Ni/Co loaded (Ni 1.2% and Co 1.2%) graphite material generated by the laser-vaporization supersonic-expansion cluster beam source connected to the FT-ICR(Fourier Transform Ion Cyclotron Resonance) mass spectrometer. The mass spectrum of the positive clusters did not show a trace of Ni or Co and were similar to higher fullerene series observed in macroscopic generation of fullerenes. On the other hand, mass spectrum of the negative ions show the signals of CoC_n , NiC_n and the intense signal from C_{74}^- and C_{76}^- . Fig.2 shows the enlargement of the positive and negative spectrum in the range of C_{70} to C_{73} . In the case of the negative ions, some rich mass spectrum due to metal atoms were observed. These were assigned as metal-carbon clusters such as CoC_{n-5} , NiC_{n-5} , $\text{Co}_2\text{C}_{n-10}$, $\text{Ni}_2\text{C}_{n-10}$ and CoNiC_{n-10} . With the chemical reaction experiments with NO, these metal-carbon clusters were proved to be very reactive.

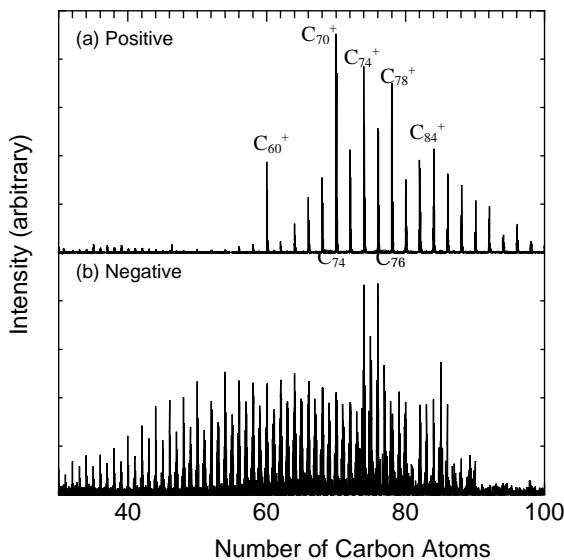


Fig1. FT-ICR mass spectrum of Ni/Co loaded graphite sample

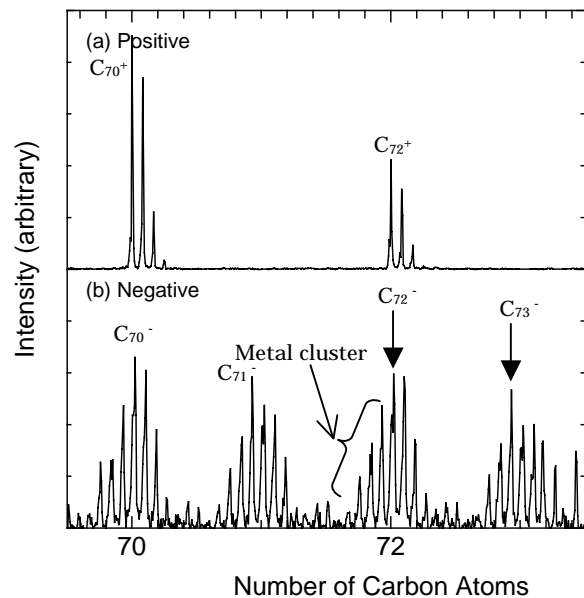


Fig2. Enlargement of C_{70} to C_{73}