Fragmentation and Ionization of Laser Desorbed $La@C_{82}$

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Highly excited $La@C_{82}$ has been investigated using laser desorption mass spectrometry. A pulsed 337 nm N_2 laser was used to desorb the fullerene material from thin films. The detected mass spectra (see figure 1) were dominated by the $La@C_{82-2m}^+$ where m = 0 - 12. The metallofullerene is fragmenting into smaller metal containing fullerenes, but empty fullerenes are detected as well as small fragments (see inset of figure). We also measure a tail after the main $La@C_{82}^+$ peak which is due to delayed ionzation. This is the first report of delayed ionization of a metallofullerene as far as we know and we suggest that metal containing fullerenes can be used as model systems for investigations into the delayed ionization of empty fullerenes. As the metals are thought to donate several electrons to the fullerene orbitals (see e.g [1]) the electronic structure of metallofullerenes should be different from that of empty fullerenes.

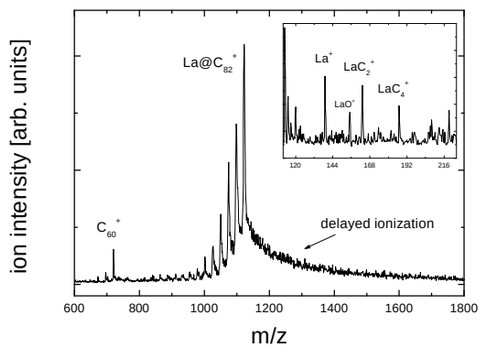

Figure 1. A $La@C_{82}$ mass spectrum showing the fragmentation by C_2 loss and loss of LaC_n. The tail after the main $La@C_{82}^+$ peak is due to delayed ionization of the metallofullerene.

The highly excited metallofullerene is fragmenting as an ordinary fullerene by C_2 loss and ionization, but has extra fragmentation channels with the loss of the internal La ion and LaC_n^+ (n = 2, 4) fragments. In comparision with mass spectra on C_{60} at similar laser conditions the $La@C_{82}$ mass spectra show more fragments created by loss of C_2 units. As the dissociation energy has been measured to be almost the same for the two fullerenes [2] we propose that the metallofullerene is fragmenting predominantly in the ionic channel.

References:

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