

## Topological Structures of C<sub>70</sub>-Peapods and Empty Single-Walled Carbon Nanotubes in Water

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We present here an “art gallery” of carbonnanotubesconsistingofrings,lassos, catenanes, pseudo rotaxanes and seed leaves structures formed from aqueous dispersions of the peapods and empty single-walled carbon nanotubes (SWNTs).

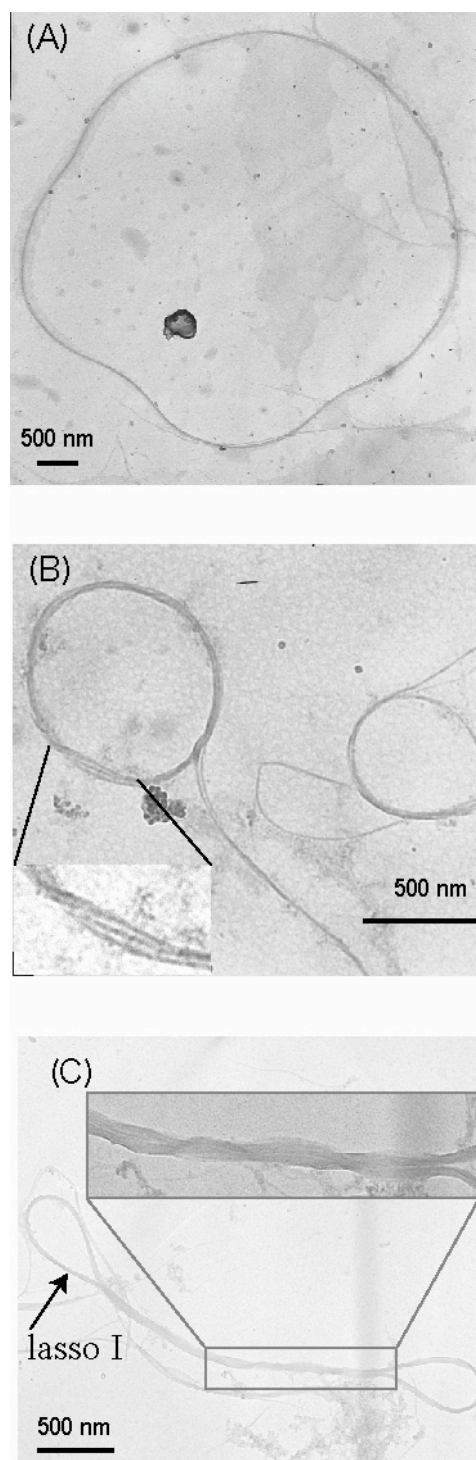
The preparation of fullerene C<sub>70</sub>-peapods has been described elsewhere.<sup>1</sup> To an aqueous solution of trimethyl-(2-oxo-2-pyren-1-yl-ethyl)-ammonium bromide (**1**)<sup>2</sup> was added solid C<sub>70</sub>-peapods or corresponding empty SWNTs and then sonicated with an ultrasonic cleaner followed by centrifugation to give a transparent black solution as a supernatant.

Figure 1 shows typical transmission electron micrograph (TEM) images of an aqueous dispersion of the peapods-**1**, in which we see highly interesting topological images including an irregular ring (Figure 1A), a lasso (Figure 1B) and a lasso with double rings (Figure 1C). No such superstructures were observed in an ethanolic dispersion of the peapods solely.

In Figure 1B and C, we can see clearly the helix structure of the peapods. We also observed similar superstructures in the aqueous solution of the corresponding empty SWNTs-**1**, indicating that the peapods structure is not essential for the formation of the superstructures. It is suggested that the topological superstructures would be formed from aggregation process via van der Waals interaction between the peapods (or empty SWNTs) dispersed/dissolved in water by the aid of compound **1**.

1) H. Kataura, et al., *Synth. Metals*, **121**, 1195 (2001).

2) N. Nakashima, et al., *Chem. Lett.*, **2002**, 638.



**Figure 1.** Typical TEM images of an aqueous dispersion of C<sub>70</sub>-peapods-**1**.