Electronic and structural properties of pristine and intercalated C60 peapods

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We report on the electronic and structural properties of pristine C60 peapods and their intercalation compounds. For SWCNT hosts with a diameter distribution of 1.37 +/- 0.12 a maximal filling ratio of 78% with C60 is observed. Therefore a 100% filling of the SWCNT which are thick enough to be filled can be achieved. Inside the peapods the interaction of the C60 peas with the SWCNT host is depending on the tube diameter. There is no polymerisation of the C60 species or charge transfer between C60 and the SWCNT in the pristine compound.

For the intercalated compounds n- (K-intercalation) and p-type doping (FeCl3-intercalation) were performed and analysed regarding the charge transfer to the peapod system. A competition between a charge transfer to the SWCNT pods and to the C60 peas is found. At low intercalation levels the charge transfer occurs predominantly to the SWCNT, whereas at higher potassium doping a significant doping of the C60 peas is observed. This leads to a distribution of differently charged C60 species inside the SWCNT. In contrast to C60 fullerides no line phases and no phase separation between the charged C60 species is observed. Hence, a rather continuous charge transfer to the C60 peas can be achieved for intermediate potassium concentration. For the fully potassium intercalated peapods we find a single phase with a C/K ratio of about six, similar to the SWCNT intercalation compounds and a charge transfer of six electrons to the C60 peas. This charged C60 phase is stabilized as a metallic one- dimensional single bonded polymer chain inside the SWCNT. This work has been supported by DFG, EU.