Anomalies in $(NH_3)_xNaK_2C_{60}$

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The superconducting fulleride $(NH_3)_xNaK_2C_{60}$ ($0<x<1$) which shows an anomalous correlation between T_C and lattice parameter[1], has been studied with SQUID magnetometry, ^{13}C and ^{23}Na NMR and X-ray diffraction in order to better understand the origin of this anomaly. The measurement of the electronic spin susceptibility with SQUID magnetometry in two differently doped samples yields a relation between T_c and the extracted density of states at the Fermi energy opposite to the Migdal-Eliashberg prediction[2]. ^{23}Na and ^{13}C-MAS measurement of the isotropic part of the Knight shift qualitatively confirm this result

For higher *x* values a non magnetic insulating phase with the same cubic structure of the pristine superconductor was detected. ^{13}C spin lattice relaxation measurements show, in this phase, an activated behaviour indicating the opening of a spin gap (E_g~ 70 meV) which is typical of the Jahn-Teller distorted even electron systems A_xC_{60} (x=2,4). This suggests a new type of metal-insulator transition (MIT) in fullerides. Unlike $NH_3K_3C_{60}$, which shows a localization of carriers through a Mott transition to a magnetic phase[3], in our case the MIT could be due to a charge disproportion among C_{60} units. The lack of a structural distortion in the insulating phase, however, indicates the dynamic nature of this process.

The recent observation of a spin gap due to a "dynamic" charge disproportion even in Na_2CsC_{60} superconducting fullerides[4], further confirms these findings.

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[2]Ricco, M., T. Shiroka, A. Sartori, F. Bolzoni, and M. Tomaselli, Europhys. Lett., 2001. **53**(6): p. 762-768.
[3]Iwasa, Y., *et al.* Physical Review B (Condensed Matter), 1996. **53**(14): p. R8836-9.
[4]Brouet, V., H. Alloul, L. Thien-Nga, S. Garaj, and L. Forro,. Phys. Rev. Lett., 2000. **86**(20): p. 4680.