

SEARCH FOR NEW HIGH TC SUPERCONDUCTORS AND UNUSUAL IRREVERSIBLE MAGNETIC BEHAVIOUR IN THREE UNRELATED MATERIALS

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Following the phase diagram of AFe_2As_2 ($A=Ba, Sr$) in which superconductivity (SC) emerges from magnetic states and the similarity between AFe_2As_2 and RFe_2X_2 ($R=La, Y$ and $Lu, X=Si$ or Ge) systems, RFe_2M_2 was proposed as a potential candidate for a new high TC superconducting family containing Fe-X (instead of Fe-As) layers as a structural unit. Dozens samples of RFe_2-xMxX_2 ($M=Ni, Mn$ and Cu) materials were synthesized and measured for their magnetic properties. None of these materials is SC down to 1.8 K. In all samples, pronounced magnetic peaks appear at various temperatures up to 232 K for YFe_2Si_2 . ^{57}Fe Mössbauer studies confirm the absence of long range magnetic ordering down to 5 K. On the other hand, traces for two SC phases (at $T_c=32$ and 66 K) have been observed in inhomogeneous commercial and fabricated amorphous carbon (a-C) doped with sulfur (a-CS). Non-SC a-CS samples, exhibit pronounced peaks in their virgin zero-field-cooled (ZFC) curves at $T_p \sim 50-80$ K. Around T_p , the field-cooled (FC) curves cross the ZFC plots. Thus at a certain temperature range $ZFC > FC$, this behaviour is irreproducible and disappears in the second ZFC and/or the FC runs. The same peculiar observation ($ZFC > FC$) was observed in two other unrelated systems: in chiral-based magnetic memory devices where the components are: α -helix L-polyalanine, Au, Al_2O_3 and Co or Ni layers. The $ZFC > FC$ phenomenon is observed only in the hard direction only. In a pathological liver tissues, the unusual $ZFC > FC$ phenomenon cannot be ascribed to extra magnetic phases (oxygen), and are an intrinsic property of these three unrelated systems. We assume that in the ground state of each system, the intrinsic local magnetic moments are randomly distributed. In the first ZFC runs, low dc magnetic fields, align these moments to flip along its direction in a FM manner up to the peak position. Above T_p , an antiparallel exchange coupling is more favoured and in the next ZFC and/or FC processes the net magnetic moments are lower and cross the ZFC branches

Biography

Israel Felner has completed PhD in 1973 from the Hebrew University (HU) of Jerusalem, Israel and Postdoctoral studies at UCSD, San-Diego, USA. Since 1973 to till date, he works at the Racah Institute of Physics at the HU. He became a Full Professor in 1995. He served as the Chairman of the Physics Studies (2003-2006). His main interest topics are: Structural, Magnetism and Mossbauer studies of Rare-earth inter-metallic, High Tc superconductivity and Magneto-Superconducting Materials and search for new High Tc Superconductors. He published more than 510 papers in reputed journals. He serves as a Chief-Editor of *Journal of Superconductivity and Novel Magnetism* and as an Editorial Board Member of *Materials Research Express* journal.

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