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Spin induced switching in gadolinium functionalized multiwall carbon nanotube nanocomposites

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We report on the switching behaviour in Multi walled carbon nanotubes (MWNTs) functionalized with a gadolimium (Gd) supramolecular complex. The nanocomposite is synthesized from a modified covalent functionalization method to enhance the strength of interaction between the CNT and the magnetic supramolecules. The structural and magnetic properties of Gd-DPTA functionalized MWNTs are exploited using various techniques namely High Resolution TEM, Magnetic force microscopy, Raman spectroscopy and SQUID magnetometry. The thermal variation of the inverse suceptibility indicates that the nanocomposite exhibits an antiferromagnetic exchange interaction. Most importantly from the low temperature transport studies at 300 mK in devices fabricated from networks of Gd-functionalized MWNTs, it was found that spin induced switching is observed which is attributed to co-tunneling in the coulomb blockade regime. The strength of the spin switching was found to be dependent on the excitation current and increased from 3 to 10% at 10 μA and 1 μA respectively. We also observed anisotropy in the switching fields as well as multiple switching events similar to nonlocal four probe measurements previously observed in single walled carbon nanotube networks. This work has potential for application in the fabrication of data storage and high speed electronic devices.

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Yes

Level for award
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PhD

Main supervisor (name and email)
and his / her institution

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