FE NANO-CLUSTERS IN RARE EARTH MATRIX

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Abstract

Structural and magnetic properties of iron nano-clusters that are formed in ytterbium films, prepared by vapor co-deposition onto Kapton substrates kept at room temperature (RT), have been investigated by X-ray absorption spectroscopy, Mössbauer spectroscopy and magnetization measurements as a function of temperature and magnetic field. EXAFS analysis indicates a short-range order for Fe atoms, which is consistent with nano-sized Fe clusters. The temperature dependence of the magnetic properties, using zero-field and in-field Mössbauer spectroscopy as well as AC and DC magnetization measurements, reveal two types of iron clusters, with non-cubic symmetry, that are associated with clusters at ytterbium grain boundaries. In addition, zero-field and in-field Mössbauer experiments indicate that the interactions within the Fe-clusters are predominantly ferromagnetic-like and their average magnetic moments are about 80 μB. As suggested by Mössbauer and AC magnetization data, the Fe-clusters are super-paramagnetic above ca. 20 K, while their magnetic behavior below this temperature is that of cluster-glass-like systems with weak inter-cluster interactions.

Keywords: Diamond nucleation, polymers, PLGA, PVA, microwave plasma

ACKNOWLEDGEMENTS:

This work was supported by CNPq/PCI, FAPERJ, FAPES, Brazilian-German research programs financed by CNPq/DFG 444BRA-113/55/0-1, DAAD/CAPES PROBRAL 56265881, and FONDECYT/CONCYTEC.

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Author did not supply full text of the paper.