BENEMÉRITA UNIVERSIDAD AUTÓNOMA DE PUEBLA

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"Local Probe Studies of Fe Pnictides: Mössbauer Spectroscopy"

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Initially we will describe the experimental facilities available at CBPF for Condensed Matter Physics and our topics of research. We will make an introduction about Mössbauer spectroscopy (MBS), giving examples of results on 57Fe MBS of Fe:ReNi2B2C family and some Fe pnictides compounds. We have studied the coexistence of magnetism and superconductivity in selected single crystals of Fe- pnictide compounds using151Eu and 57Fe MS. Neutron diffraction studies on Ba1- xKxFe2As2 and Ni-doped BaFe2As2 single crystals revealed a decrease in the Bragg peak intensity below TC that can be due to a reduction of iron moments or magnetic volume fraction, since this method can determine only the product of these two quantities. Detailed 57Fe Mössbauer measurements on some of those single crystal mosaics were performed below TN and below TC. The spectra analysis r e v e a l s an unusual decrease in the magnetic hyperfine field below TC without change in the magnetic volume fraction. Therefore, our data confirm that a reduction of Fe magnetic moment occurs at TC explaining also the neutron diffraction results. Another example of coexistence of magnetism and superconductivity is g i v e n b y the Eu Fe2As1.4P0.6 compound, where the magnetism comes from the Eu2+moments. All MS spectra reveal magnetic hyperfine fields below the magnetic ordering temperature TM=18K of the Eu2+moments. The data analysis also shows that there is a coexistence of ferromagnetism, resulting from Eu2+moments ordered along the crystallographic c-axis, and superconductivity below TSC~ 15 K. We find indications for a change in the dynamics of the small Fe magnetic moments (~0.07 ;B) at the onset of superconductivity: below TSC the Fe magnetic moments seem to be "frozen" within the a,b-plane. In the studied c o m p o u n d s we were able to show a change in the Fe magnetic moment state when entering the SC state. It is argued that such a decrease is caused by a spectral weight transfer when entering the superconducting state, w h i c h i s explained assuming as +- pairing symmetry. Mössbauer spectra obtained from Ni-doped BaFe2As2 also revealed a decrease of the hyperfine field below TC, and we also observe a correlation between nonmagnetic volume fraction, the variation of the magnetic hyperfine field and Ni-doping. These results confirm that we have coexistence and competition between magnetism and superconductivity, if we assume a phase separation whose dimension is smaller than the coherence length.

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