

Superconductivity and Magnetism of Fe-based AFe_2As_2 and $B_xFe_2Se_2$ Systems Studied by Magnetization and Mössbauer Spectroscopy (LT26)

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Mössbauer spectroscopy (MS) in conventional superconductors yields little information. However, in the new magneto-superconductors where SC is confined to the Fe-As or Fe-Se layers, ^{57}Fe MS may contribute much, since the Fe ions are not probes, but rather part of the layers to which SC is confined. MS and Magnetization studies of a large variety of AFe_2As_2 ($A=\text{Ba}, \text{Eu}$) and $B_xFe_2Se_2$ ($B=\text{K}, \text{Rb}$ and Tl) single crystals, including substitutions of Fe by Co or Ni or As by P in the AFe_2As_2 system have been performed. We shall summarize our present knowledge about the phenomena observed to date, including the results obtained in the new $B_xFe_2Se_2$ systems, in which the high AFM state ($T_N > 500$ K) coexists with SC (below 30 K) within the same Fe layers. In some SC materials, the paramagnetic Meissner effect up to 20 Oe and double peaks in the hysteresis loop are observed. Of particular interest is the $\text{EuFe}_2(\text{As}_{1-x}\text{P}_x)_2$ system, for which the two Mössbauer isotopes, ^{57}Fe and ^{151}Eu , enable to investigate simultaneously the mutual interactions between the magnetic Eu and the Fe layers. $\text{EuFe}_2(\text{As}_{1-x}\text{P}_x)_2$ is SC for $0.2 < x < 0.5$. For $x \geq 0.2$ the Eu sublattice is FM ordered along the **c**-axis but AFM ordered for $x \leq 0.2$ with the moments aligned in the **ab** planes. In the FM region, the magnetic transitions and the magnetic hyperfine fields (H_{eff}) of the Eu nuclei are higher than those in the AFM region. Fe is magnetic for $x \leq 0.2$ but not magnetic for $x \geq 0.2$, yet displays transferred H_{eff} from the Eu sublattice.