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Soft Magnetic Materials
CARDIFF 2007

Soft Magnetic Materials Conference (SMM 18)

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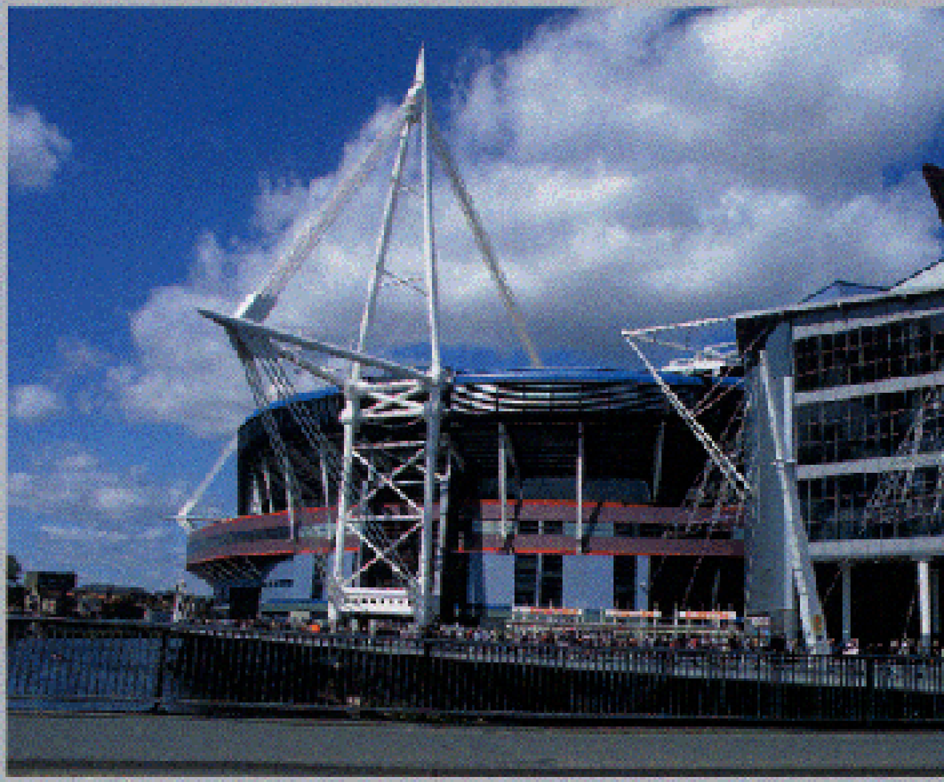

2nd - 5th September 2007
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ROOM-TEMPERATURE FERROMAGNETIC PROPERTIES AND MÖSSBAUER INVESTIGATION OF THE $0.7FETIO_3$-$0.3FE_2O_3$ SOLID SOLUTION

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Solid solution of (1-x)$FeTiO_3$-xFe_2O_3 ($0.1<x<0.5$) are potentially interesting spintronic materials in diluted magnetic semiconductor.[1-3] The $0.7FeTiO_3$-$0.3Fe_2O_3$ solid solution were prepared by slow cooling and quenching heat treatments and studied by X-ray diffraction, vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. The crystal structure of samples were found to be rhombohedral structure and both the slowly cooled and quenched samples did not show any secondary phases. The temperature dependence of the magnetization taken in zero-field-cooling (ZFC) and field-cooling (FC) condition of the slowly cooled and quenched samples exhibits the great irreversibility between ZFC and FC magnetization Magnetization measurements indicate ferromagnetic behavior with hysteresis loops at 50 and 300 K both the slowly cooled and quenched samples. The coercivity values (H_c) at 50 and 300 K are $H_c = 295$ and 30 Oe in the slowly cooled sample and $H_c = 957$ and 187 Oe in the quenched samples, respectively. Mössbauer spectra of $0.7FeTiO_3$-$0.3Fe_2O_3$ solid solution were taken at various temperature ranging from 4.2 to 400 K and anomalous absorption curves are observed. Mössbauer patterns of two samples show the paramagnetic behavior persists over a rather wide temperature range below the Néel temperatures of solid solution. These results are interpreted as a consequence of inhomogeneity in the magnetic structure, due to competing interaction as a result of the Ti ions being disordered within the layer. By using these results, the Mössbauer absorption by $0.7FeTiO_3$-$0.3Fe_2O_3$ solid solutions can be interpreted as a superposition of the absorption peaks of Fe^{2+} and Fe^{3+}. The Néel temperature (T_N) was determined to be 380 K for the slowly cooled sample and 400 K for the quenched sample. The increase of magnetic transition temperature originates from the distributions of magnetic Fe ion at forming sublattices A[xFe^{3+}, (1-x)Fe^{2+}] and B[xFe^{3+}, (1-x)Ti^{4+}] and the strength of exchange interaction between magnetic ions. At 4.2 K, the magnetic hyperfine field were 511 kOe, 465 kOe, and 334 kOe for the slowly cooled sample and 510 kOe, 446 kOe, and 284 kOe for the quenched samples, respectively.

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