

Micro-structural change and high temperature properties of constituent elements (Fe, Co, Mn, Cu) in spin valves containing oxide layers

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Abstract: Neither the reaction mechanism of chemical elements (Mn, Fe, Co) in specular spin valves (SVs) nor the microstructures of specular SVs containing oxide layers (OXLs) at high temperatures ($>250\text{ }^{\circ}\text{C}$) have been identified so far. We attempted to solve these problems via secondary-ion-mass spectroscopy, x-ray photoelectron spectroscopy depth profile analysis, x-ray diffraction analysis and x-ray transmission electron microscopy. The chemical properties of the constituent elements in SVs and a change in the microstructure are found to be the main reasons for magnetoresistance (MR) ratio degradation at high temperatures. We also found that it is not only Mn atoms but also the OXL/ferromagnetic interface, which is an intermixed region with Cu atoms, that causes MR ratio degradation at temperatures above $275\text{ }^{\circ}\text{C}$. ??
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Index Keywords: Copper; Degradation; Iron; Magnetoresistance; Oxides; Problem solving; Transmission electron microscopy; X ray analysis; Oxide layers (OXL); Ratio degradation; Spin valves; Microstructure

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