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Giant electroresistance and giant magnetoresistance of Fe-doped amorphous carbon film on Si substrate XIAOZHONG ZHANG, PENG TIAN, QINGZHONG XUE, Dept of Materials Science and Engineering, Tsinghua University, PR China — Amorphous $\text{Fe}_x\text{-C}_{1-x}$ films are deposited on Si substrates at different temperatures using pulsed laser deposition (PLD). It is found that the resistance of $\text{Fe}_x\text{-C}_{1-x}$ films on Si (100) substrates are controlled by the measuring current within a given temperature range. Correspondingly, giant electroresistance (ER) and giant magnetoresistance (MR) were found in this material. For example, $\text{Fe}_{0.011}\text{-C}_{0.989}$ film has a positive MR of 138% at temperature of 300K and magnetic field of 5T. It is found that the switching of the conducting channel from the $\text{Fe}_x\text{-C}_{1-x}$ film to the Si substrate plays an important role in the current-dependent resistance of $\text{Fe}_x\text{-C}_{1-x}$ films. The multilayer of $\text{Fe}_x\text{-C}_{1-x}$ films on Si (100) substrate was also prepared by PLD. This multiplayer material has a positive MR of over 30% at low magnetic field, and the MR sensitivity is comparable to the spin-valve structure of traditional GMR materials. However, this material has a novel MR mechanism. It is believed that this multiplayer material can find application in magnetic information storage such as magnetic sensors, magnetic recording head and magnetic random access memory.

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