



národní
úložiště
šedé
literatury

Preparation of Thin Layers of Ferromagnetic Semiconductors

Koštejn, Martin
2014

Dostupný z <http://www.nusl.cz/ntk/nusl-174821>

Dílo je chráněno podle autorského zákona č. 121/2000 Sb.

Tento dokument byl stažen z Národního úložiště šedé literatury (NUŠL).

Datum stažení: 02.05.2024

Další dokumenty můžete najít prostřednictvím vyhledávacího rozhraní [nusl.cz](http://www.nusl.cz) .

Preparation of Thin Layers of Ferromagnetic Semiconductors

Student: Ing. Martin Koštejn

Supervisor: RNDr. Radek Fajgar, CSc.

Supervisor-specialist: Prof. Ing. Pavel Fiala, CSc.

Recently there is a big demand for finding new materials usable in computing devices for improving performance and power consumption. One group of such materials is called ferromagnetic semiconductors (FMS).

Nowadays there are no industrially produced FMS materials. For using of the spin polarized current it is necessary to add ferromagnetic properties into semiconductor materials. One proposed way is an incorporation of metal atoms (manganese) in a semiconductor from group IV A (silicon or germanium). The incorporated metal should have a half-filled outermost electron shell, which brings the best magnetic moment of an atom.

Highly non-equilibrium conditions are applied for a preparation of Si/Mn or Ge/Mn amorphous materials by a reactive excimer laser ablation. A manganese target is ablated under a low pressure of silane (SiH_4) or germane (GeH_4) by a focused ArF laser beam. The ablated manganese atoms interact with SiH_4 or GeH_4 molecules in the gas phase. As a result, thin amorphous silicon or germanium layers with the incorporated manganese atoms (with concentrations up to 50 %) are deposited. The deposited layers are analysed by electron microscopy (both scanning and transmission), X-ray photoelectron spectroscopy and SQUID (superconducting quantum interference device) techniques. An electron diffraction is used for identification of nano-crystallites formed by annealing of the deposit at temperatures up to 1100 °C.

References

1. E. S. Demidov, et al., High-temperature ferromagnetism in laser-deposited layers of silicon and germanium doped with manganese or iron impurities. *J. Magn. Magn. Mat.* 321 (2009) 690–694
2. L. Ottaviano, et al., Room-temperature ferromagnetism in Mn-implanted amorphous Ge. *Phys. Rev. B* 83, (2011) 134426