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Search for ferromagnetic ordering in Pd doped wide band gap semiconductors GaN and ZnO

GaN and ZnO are candidates for dilute magnetic semiconductors with Curie temperatures above room temperature [1]. Doping with transition metals (TM) like Co, Mn or Fe is a simple way to create such systems. The PAC probe $^{100}\text{Pd}/^{100}\text{Rh}$ is isoelectronic to cobalt and therefore a perfect tool to investigate the incorporation of TM's into these compounds as well as the influence of other impurities onto the internal magnetic fields. (0001) and (1010) oriented ZnO single crystals samples, freestanding GaN films and GaN thin films on $6\ \mu\text{m}$ thick sapphire substrates were recoil-implanted with the $^{100}\text{Pd}/^{100}\text{Rh}$ probe as described in detail elsewhere [1]. The probe was produced using the fusion evaporation reaction $^{92}\text{Zr}(^{12}\text{C},4n)^{100}\text{Pd}$ at a beam energy of 70 MeV. After recoil implantation PAC spectroscopy was performed at room temperature. The samples were measured as-implanted, and following isochronal annealing for 10 min at increasing temperatures.

First results without and with an applied external magnetic field (Fig. 1) are indicative of a strongly disturbed lattice vicinity of Pd impurities in both hosts. No signs of spontaneous ferromagnetic ordering were observed.

References

[1] T. Dietl, Science, 287, 1019 (2000).

[2] E. Bezakova, Ph.D. thesis, Australian National University, Canberra, (1998).

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