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High deuteron Polarization in polymer target materials

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The Dynamic Nuclear Polarization (DNP) is an efficient technique to enhance the nucleus polarization by the so-called ´Radiation doping´ or ´Radical chemically doping´ methods in the field of polarized solid targets for their use in nuclear and particle physics experiments [1]. Polymer materials have been used since 1994 due to the advantage of its easy handling at room temperature and shape controlling in a special thin target [2]. We studied the deuteron polarization of polymer materials, D-polyethylene and D-polystyrene, with ´Radiation-doping and ´Radical chemically doping´, respectively. By the irradiation with 20 MeV electrons from the Bonn Linac of the ELSA accelerator on D-polyethylene at a range from $1.0 \times 10^{15} - 1.0 \times 10^{17} e^{-}/cm^{2}$, a polarization 31% has been obtained at the DNP conditions of 2.5T and 150mK.
On the other hand, D-polystyrene material was prepared for the DNP by doping it with the radical ´Finland D36´, which is a prominent member of the trityl radicals. A deuteron polarization of 32% has been measured at 2.5T and 1 K. At 5 T and 400 mK, this value has been considerably improved to >60% with a polarization build-up time of a few hours [3].

[1] St.Goertz et al., Progress in Pratical and Nuclear Physics, 49, 403-489 (2002)

[2] B.van den Brandt, et al., Nucl. Instr. and Meth. A 356, 36-38 (1995)

[3] Li Wang et al., Nucl. Instr. and Meth. A 729, 36-40 (2013)

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