Development of deuterated polymer target materials

[1,2]Li.Wang, [1]W.Meyer*, [1]Ch.Hess, [1]E.Radtke, [1]A.Berlin, [1]J.Herick, [1]G.Reicherz, [3]N.Doshita, [3]K.Kondo, [3]T.Iwata, [4]N.Horikawa

[1]*Institut of Experimental Physics AG I, Ruhr-University Bochum, Bochum, D-44780, Germany*

[2]*Physics Department, School of Science, Donghua University, Shanghai, 200051, China*

[3]*Physics Department, Faculty of Science, Yamagata University, Yamagata, 990-8560, Japan*

[4]*College of Engineering Chubu University, Kasugai, 487-850, Japan*

**meyer@ep1.rub.de*

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 20MeV electrons from the Bonn Linac of the ELSA accelerator on D-polyethylene at a range from 1.0×10^{15}-1.0×10^{17}e-/cm^2, a polarization 31% has been obtained at the DNP conditions of 2.5T and 150mK. In the case of chemical doping method (TEMPO or Trityl Finland D36), no remarkable polarization has been obtained. The problem of Finland D36 seems to be its solubility into the solvent.

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 1K. At 5T and 400mK, this value has been considerably improved to >60% with a polarization build-up time of a few hours[3].

REFERENCES:

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