



Contribution ID: 241

Type: Talk

Breakthrough in neutron backscattering spectroscopy: A tenfold enhanced energy resolution using GaAs

Tuesday, 18 September 2018 14:30 (15 minutes)

A prototype neutron backscattering spectrometer using the GaAs 200 Bragg reflection has been developed to bring about a substantial increase in energy resolution. Test measurements on the backscattering spectrometer IN16B at the ILL have yielded an unprecedented resolution of $\delta E = 77$ neV FWHM [1], an order of magnitude smaller than the current standard of 750 neV FWHM as well as a factor of 4 smaller than the highest currently available resolution of 300 neV FWHM.

In order to retain the high resolution offered by the narrow intrinsic line width of GaAs 200, several parameters need to be controlled to a high degree of precision, such as variations of the lattice parameter to $(a/a) < 10^{-6}$, temperature inhomogeneities to $T < 0.3$ K over 10 m^2 of crystal surface, co-alignment of $4 \times 4 \text{ mm}^2$ crystal facets to $< 0.1^\circ$, or mechanical strain to $< 10^{-6}$. Therefore, the prototype is modularised into small-scale components and equipped with a multi-channel temperature control system.

Further, we measured the hyperfine splitting in cobalt as a benchmark, providing proof of concept for the construction of a full-scale user instrument.

[1] K. Kuhlmann, M. Appel, B. Frick and A. Magerl, ILL Annual Report 2017, p. 82–83

Primary authors: KUHLMANN, Kristijan (Friedrich-Alexander University Erlangen-Nürnberg / Institut Laue-Langevin); APPEL, Markus (FAU Erlangen-Nürnberg / ILL); FRICK, Bernhard (Institut Laue-Langevin); MAGERL, Andreas (University Erlangen-Nürnberg)

Presenter: KUHLMANN, Kristijan (Friedrich-Alexander University Erlangen-Nürnberg / Institut Laue-Langevin)

Session Classification: Parallel session 1

Track Classification: P1 Instrumentation and methods