

First magnon of BATAN's neutron triple-axis spectrometer / I. Sumirat

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Deskripsi Lengkap: <https://lib.ui.ac.id/detail?id=20441069&lokasi=lokal>

Abstrak

The National Nuclear Energy Agency of Indonesia (BATAN) has one dedicated spectrometer for inelastic neutron scattering experiments. The instrument is a thermal neutron triple-axis spectrometer known as SN1. SN1 was installed in 1992 in the experimental hall of G. A. Siwabessy Research Reactor, Serpong, Banten. Malfunctions of the hardware and software have prevented the instrument from performing inelastic scattering measurements since 1996. The 2011-2015 five years project has been initiated to revitalize and optimize the SN1. The project serves as a preparation for the utilization of SN1 for the investigation of lattice dynamics, spin wave and magnetic excitations in condensed matters that will be started in 2016. In 2013, SN1 has successfully been repaired and was able to measure phonon dispersion relation of available single crystals, i.e., Cu, pyrolytic graphite (PG), Ge, and Al. In 2015, the first experiment on magnetic excitation to investigate magnon dispersion relation of a known Fe single crystal has been carried out. Standard methods of inelastic scattering measurements, i.e., a constant-energy transfer $\hbar\omega$; with either fixed final neutron energy $E_f = 14.7$ meV or fixed incoming neutron energy $E_i = 30.59$ meV, and a constant momentum transfer Q with fixed incoming neutron energy $E_i = 30.59$ meV, were applied to measure the low-energy magnetic excitations. For fixed E_f measurement, a 5-cm thick PG filter was set between the sample and the analyzer to eliminate n harmonics. To limit the energy and momentum spreads of the beam, collimations of 40 minutes were applied before and after the sample. The spin waves were measured along the three principal symmetry directions of $[00\pi;]$, $[\pi/2;\pi/2;0]$, and $[\pi/2;\pi/2;\pi/2]$. The measured magnons were compared to values in reference and were found to be in a good agreement with them. With such accomplishments, we are convinced that SN1 is now ready for its inelastic scattering application and will become one of BATAN's neutron instrument which is routinely utilized for materials characterization on lattice dynamics and magnetic excitations by local and foreign scientists. Besides reporting the SN1 first measured magnon, the current status of SN1 instrument development will also be presented briefly.