

International Symposium on Optical Science and Technology
SPIE's 47th Annual Meeting, 7 to 12 July 2002, Seattle, WA, USA

AM 311: Advances in Neutron Scattering Instrumentation

Silicon-based glancing incidence reflection superposition lens

Alexandru Dan Stoica and Xun -Li Wang

Spallation Neutron Source (SNS), Oak Ridge, TN

Many topics of interest for neutron scattering demand small sampling volumes. Then the scattering instruments should include focusing devices in order to deliver a sharp spatially shaped neutron beam at the sample position. Moreover the wavelength bandwidth should be sufficiently large if time-of-flight method is used.

In this contribution a new compact focusing device is proposed. The device is made of a stack of bent silicon wafers, each having a glancing reflective layer deposited on one side and a neutron absorbing layer on the other side. This device acts as a lens by superposing the images delivered by individual mirrors. The aberrations are minimized due to the short length of the device. From this point of view this type of superposition lens is equivalent to a long elliptic or parabolic mirror. Consequently a two dimensional focusing could be obtained by combining two devices in a Kirkpatrick-Baez set-up.

Basic design principles are described and Monte-Carlo simulation results are presented. Possible applications in powder and single crystal diffraction are reviewed. By exploiting the imaging properties of this device the diffraction mapping technique could be enhanced using appropriate data multiplexing procedures.