

Designing and Constraints in the Development of Focusing Small Angle Neutron Scattering Beamline at a Small Research TRIGA Reactor

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(Received December 8, 2011)

A Monte-Carlo ray tracing simulation together with an analytical approach were carried out to understand flux characteristics and performance of the small angle neutron scattering (SANS) instrument at the Malaysian Nuclear Agency's 1 MW TRIGA reactor. The low flux and limited Q range of the instrument can be further improved by developing the instrument as focusing SANS. The use of misaligned HOPGs as monochromator can increase the $\Delta\lambda/\lambda$ thereby increasing the flux at sample position. In this case, a much tighter collimation can be used to get better Q_{\min} . This paper explains a misaligned HOPGs design concept, constraints and possible approaches to achieve a higher flux and the modification needs to establish a focusing SANS at small research reactor.

PACS numbers: 61.05.fg, 28.20.Cz, 28.50.Dr

I. INTRODUCTION

Most neutron scattering instruments are built at research reactor with high power capacity (> 10 MW). This is to ensure that these scattering instruments receive large neutron flux for scattering experimentations. These neutron scattering instruments are always fully utilized thus not easily available to be used. There are many small-scale research reactors in the world but most of them are not suitable for neutron scattering instruments because the neutron flux at sample position is unreasonably low. Nevertheless, through some insightful instrument configuration and design, it is possible to increase flux of neutron scattering instrument at small-scale research reactor to the point that it would be practical to carry out meaningful neutron scattering experiment. This paper will look into the possibility of achieving such objective, with small-angle neutron scattering (SANS) instrument taken as case of study. At the Malaysian Nuclear Agency, the SANS facility there (mySANS) is utilizing the low flux of thermal neutron from a radial piercing beamport at the agency's 1 MW TRIGA reactor. It has been used mostly by students on certain area of problems that relate to samples containing strong scatterers or contrast for educational purpose. The design of this 8-metre SANS facility allow object resolution only in limited Q range with the 2-dimensional position sensitive detector fixed at 4 metres from the sample.

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