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Advances in design simulation of supermirror polariser

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Neutron polariser and analyser based on polarising supermirror technology [1-3] have been enabling the widespread use of polarised neutrons in the past decades. Polarising supermirror operates on polarised neutron reflectometr yprinciple san di shighl ysensitiv et oinciden tneutro ' s wavelength and incident angle. Modern neutron beamline ofte nuse sneutro noptica lelement ssuc ha s acombinatio no fcurve dan delliptica neutron guides to get out of the line of sight to the moderator, increase the transport of selected neutrons and focus the beam onto a sample. A polariser is placed either inline in a section of the neutron guides or at the guide exit in the experimental enclosure. At those locations, the beam characteristics are complex, making it necessary to use simulation for the design evaluation of the polariser. At present, the leading simulation softwar ear eMcSta s[4,5]an dVites s[6] .Whil eman ypolarisin gdevice shav ebee nincorporated ,th complexity of the interaction between neutron and polarising supermirror and the increasing sophistication of beamline design demand further development of the simulation code to include physical processes that could previously be omitte d[7] .W erepor ther e adevelopmen tthat ,i nadditio nt opolarisation-dependen reflectio nan dtransmissio na tth esupermirro rcoating ,als oinclude stransmissio nan dabsorptio ni nsubstrate refraction at the substrate interface, and multiple internal reflectio ni ndouble-sid ecoate dsupermirror .A tth device level, multiple reflectio nbetwee nsupermirror sha sals obee ninclude din ,e.g .v-cavit ypolariser .T results revealed internal reflection si n asubstrat ean dcross-tal kbetwee nsupermirror sca nsignificant lyaff the performance. Consequently, mitigations have been incorporated in our polariser designs to archive, for instance, 95% polarisation and 42% transmission at 2 Å for a v-cavity polariser. We will present our finding and the results of polariser design for ESS instruments using the new code.

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