Low dimensional neutron moderators for enhanced source brightness - DTU Orbit

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**Low dimensional neutron moderators for enhanced source brightness**

In a recent numerical optimization study we have found that liquid para-hydrogen coupled cold neutron moderators deliver 3–5 times higher cold neutron brightness at a spallation neutron source if they take the form of a flat, quasi 2-dimensional disc, in contrast to the conventional more voluminous shapes used by now. In the present paper we describe a simple theoretical explanation of this unexpected behavior, which is based on the large difference in para-hydrogen between the values of the scattering mean free path for thermal neutrons (in the range of 1 cm) and its much larger equivalent for cold neutrons. This model leads to the conclusions that the optimal shape for high brightness para-hydrogen neutron moderators is the quasi 1-dimensional tube and these low dimensional moderators can also deliver much enhanced cold neutron brightness in fission reactor neutron sources, compared to the much more voluminous liquid D2 or H2 moderators currently used. Neutronic simulation calculations confirm both of these theoretical conclusions.

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