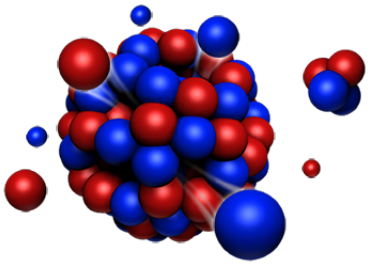

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Solid methane in radiation: Thermodynamic simulation using Arrhenius equations

Monday, 14 October 2019 16:30 (2 hours)

The effects of radiation damage in methane are of great interest to both the spallation neutron source and astrophysics communities. Solid methane is by far the most efficient medium to use in neutron source moderators, taking energy from hot neutrons produced by the target at a rate 3.5 times that of hydrogen moderators. However the practical use of such moderators has been much more challenging than first expected, due to the production of radiation defects which, at some critical number, lead to a spontaneous self-accelerated recombination process, the 'burp'effect [1].

Here we present a thermodynamic simulation of the ISIS Neutron and Muon Source's solid methane moderator, which shows good agreement with moderator test data. Our model aims to include as many known values as possible, in order to provide a realistic view of moderator performance. It is hoped that by using our model as an investigative tool, we will be able to mitigate the 'burp'phenomenon in the ISIS moderators, thus increasing the instrument uptime and measurement stability.

[1] J. M. Carpenter, Nature, 330, 358 (1987)

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