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Investigation of temperature distribution and phase of InBi eutectic alloy through energy resolved neutron imaging

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The possibility to measure neutron transmission spectra in each pixel of imaging dataset enables various studies of microstructure within solid materials. Among these studies there is a possibility to map the temperature distribution within materials without direct access to them, e.g. enclosed within other structures. Variation of both Bragg edge wavelength and the width of neutron resonance absorption with temperature can be utilized for such temperature mapping, providing the neutron transmission spectrum can be measured in a wide energy range. Neutron spallation sources provide the opportunity to measure neutron transmission in a wide range of energies, all in one measurement [1-5].
In this paper we demonstrate how temperature distribution maps can be reconstructed for an InBi eutectic alloy sealed within a brass container. We also demonstrate that transition from liquid to solid phase can be studied within a closed container with sub-mm spatial resolution through the analysis of neutron resonance absorption spectra. Such analysis can be beneficial for non-destructive testing of various solid materials and for in-situ studies where materials are enclosed within structures opaque to other conventional techniques.

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