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3D Velocity Vector Measurements in a Liquid-metal by Using Image Unsharpness in Neutron Transmission Images

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To investigate liquid metal flow has critical importance in many industrial applications like metallurgy and Nuclear engineering. However, it is still difficult to measure the liquid metal flow at high temperature at present. Recently ultrasonic velocity measurement becomes one of the important measurement methods in such liquid metal flow, but its applicable temperature range is still limited to relatively low temperature level. Neutron Imaging can be applied to the velocity field measurements of liquid metal two-phase flow, which has been studied by the present author. Using only one neutron source, two-dimensional behavior of tracer particles dispersed in liquid metal flows can be visualized by traditional neutron imaging. In this study, the image unsharpness of the tracer particles was analyzed to obtain the 3-dimensional positions of the tracer particles in the liquid-metal flow. The purpose of this study is to investigate the accuracy of the 3-D velocity vector measurements in a liquid-metal single phase flow. Experiments have been performed at the Kyoto University Research Reactor by using low-melting-point Liquid-metal (Newton alloy, 97 deg. C melting point) to with AuCd3 particles, which have almost the same density as the liquid-metal.

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