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Highly collective atomic transport mechanism in high-entropy glass-forming metallic liquids

Changjiu Chen[1], Kaikin Wong[1], Rithin P. Krishnan[1], Lei Zhifeng[2], Dehong Yu[3], Zhaoping Lu[2], and Suresh M. Chathoth[1,*]

[1]*Department of Physics, City University of Hong Kong, Kowloon Tong, Hong Kong, China*

[2]*State Key Laboratory for Advanced Metals and Materials, University of Science and Technology, Beijing,100083, China*

[3]*Australian Nuclear Science and Technology Organization, Lucas Height, 2234, Australia*

*Corresponding author. Dr. Suresh M. Chathoth, Ph.D.; Tel.: +852 3442 4967; Fax: +852 3442 0538; *Email address*: smavilac@cityu.edu.hk (S. M. Chathoth)

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Quasielastic neutron scattering (QENS) has been used to study the atomic relaxation process and microscopic transport mechanism in high-entropy glass-forming metallic (HE-GFM) liquids. Self-intermediate scattering functions obtained from the QENS data show unusually large stretching, which indicates highly heterogeneous atomic dynamics in HE-GFM liquids. In these liquids, a group of atoms over a length scale of about 21 Å diffuses collectively even well above the melting temperature. However, the temperature dependence of diffusion process in one of the HE-GFM liquid is Arrhenius, but in the other HE-GFM liquid it is non-Arrhenius. Although the glass-forming ability of these HE-GFM liquids is very poor, the diffusion coefficients obtained from the QENS data indicate the long range atomic transport process is much slower than that of the best metallic glass-forming liquids at their melting temperatures.

Keywords: High-entropy alloy, Neutron scattering, Atomic relaxation, Diffusion