ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Unusual plastic instabilities in entropy alloys at elevated temperatures

T. Tayari[a], M. Knapek[a], P. Minárik[a], J. Stráský[a], J. Pešička[a]

[a]*Charles University, Faculty of Mathematics and Physics, Department of Physics of Materials, Ke Karlovu 5, CZ-121 16 Prague, Czech Republic*

[a]*tayari@karlov.mff.cuni.cz*

Entropy metallic alloys consisting of two to four principal elements (medium-entropy alloys) or more than four principal elements (high- entropy alloys), as first proposed in 2000s, have recently attracted an extensive attention of materials scientists. This contribution presents a systematic study of serrated flow of the FeAlCrMo and FeAlCrV medium-entropy alloys in compression, first observed at 400 °C and a strain rate of 10-4 s-1. These parameters were further varied in order to evaluate how they affect the deformation behavior. Compression curves and strain rate jump tests suggest that dynamic strain aging (i.e. the Portevin-Le Châtelier (PLC)) effect is responsible for the jerky flow. During compression, three most common types of the PLC effect are observed at different conditions. Results of the conventional compression tests are also correlated with the concurrently recorded acoustic emission (AE) data. The AE data suggest that the serrations most likely result from a sequence of dislocation avalanches rather than from individual ones with very high magnitude. Furthermore, at certain conditions, peculiar periodic serrations appeared throughout plastic loading, which possessed bimodal distribution of drop magnitudes. In this multicomponent material, this effect likely originates in complex dislocation-solutes interactions at the atomic scale.

Keywords: High entropy alloy; deformation; plastic instability; in-situ testing