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2000% superplasticity in a nanostructured high-entropy alloy processed by high-pressure torsion

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High Strain-Rate Superplasticity (HSRS) is extremely rare in high strength materials, and the lack of superplastic forming capability in a recently emerged class of high-strength materials, the so-called High-Entropy Alloys (HEAs), is a serious obstacle for its potential use in engineering complex structures. HEAs have a unique alloy design concept based on multi-principle elements, and they exhibit remarkable properties such as high strength combined with high ductility as well as high fracture toughness when compared to conventional alloys [1]. Thus, achieving HSRS in HEAs would signify a huge breakthrough in advanced material science. In this presentation, we present a superplastic elongation to 2,000% of the original length at a high strain rate of 5×10^{-2} s^{-1} in an $Al_9(CoCrFeMnNi)_{91}$ (at%) high-entropy alloy nanostructured using high-pressure torsion. The high-pressure torsion-induced grain refinement in the multi-phase alloy combined with limited grain growth during hot plastic deformation enables high strain rate superplasticity through grain boundary sliding accommodated by dislocation activity [2,3].

Keywords: High-entropy alloy, Superplasticity, Nanostructure, High-pressure torsion

References:

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