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

Superposition of strengthening mechanisms in hot forged $Al_xCoCrFeNi$ high entropy alloys

Ayush Sourav[a], Shanmugasundaram Thangaraju[a]

[a]*Department of Metallurgical and Materials Engineering, Defence Institute of Advanced Technology, Pune, India- 411025*

[a]*ayushsourav203@gmail.com and thangaraju@diat.ac.in*

$Al_xCoCrFeNi$ is one of the most extensively studied high entropy alloy system, as it shows a dynamic change of properties with the variation of Al. In this work, $Al_xCoCrFeNi$ (x=0.3, 0.5, 0.7) alloys were hot-forged at 1250℃. Various characterization techniques such as optical microscopy, x-ray diffraction (XRD), electron backscatter diffraction (EBSD), energy dispersive x-ray spectroscopy (EDS), and hardness tests were carried out to evaluate structure-property relationship. The $Al_{0.3}$ alloy possesses a single-phase face-centered cubic (FCC) structure, whereas $Al_{0.5}$ and $Al_{0.7}$ have dual-phase FCC and body-centered cubic (BCC) structure. An increase in the FCC phase fraction was observed in all the alloy compositions after forging. Forging of alloys increased the hardness of $Al_{0.3}$ and $Al_{0.5}$. In contrast, a reduction in hardness was observed in $Al_{0.7}$ alloy. Microstructure analysis revealed that phase fraction, twins, low angle grain boundaries, and grain refinement are major factors for structure-property relation. Contributions from different strengthening mechanisms were estimated, and a modified rule of mixture is proposed to evaluate the strength of these alloys from the microstructural features.

Keywords: High Entropy alloy; structure-property relation; hot deformation; microstructure; multiphase alloy

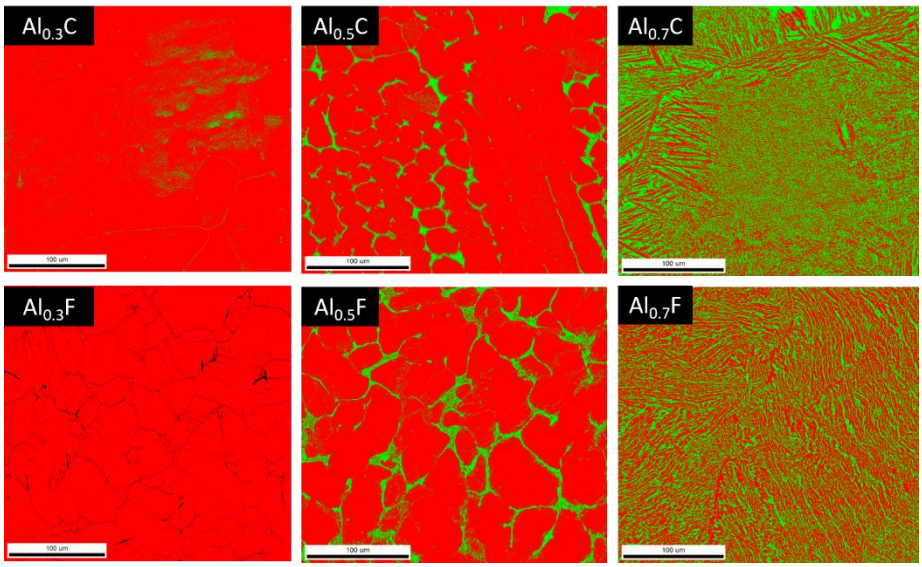

Fig.1 EBSD phase mapping of $Al_xCoCrFeNi$ in cast and forged conditions.