

High Temperature Deformation Behavior of Al_{0.2}CoCrFeNiMo_{0.5} High Entropy alloy

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Abstract : The efficiency of thermally operated systems can be improved by increasing the operating temperature, thereby decreasing the fuel consumption and carbon footprint. Hence, there is a continuous need for replacing the existing materials with new alloys with higher temperature working capabilities. During the last decade, multi principal element alloys, commonly known as high entropy alloys are getting more attention because of their superior high temperature strength along with good high temperature corrosion and oxidation resistance, The present work focused on the microstructure and high temperature tensile behavior of Al_{0.2}CoCrFeNiMo_{0.5} high entropy alloy (HEA). Wrought Al_{0.2}CoCrFeNiMo_{0.5} high entropy alloy, produced by vacuum induction melting followed by thermomechanical processing, is tested in the temperature range of 200 to 900oC. It is exhibiting very good resistance to softening with increasing temperature up to 700oC, and thereafter there is a rapid decrease in the strength, especially beyond 800oC, which may be due to simultaneous occurrence of recrystallization and precipitate coarsening. Further, it is exhibiting superplastic kind of behavior with a uniform elongation of ~ 275 % at 900 oC temperature and 1 x 10⁻³ s⁻¹ strain rate, which may be due to the presence of fine stable equi-axed grains. Strain rate sensitivity of 0.3 was observed, suggesting that solute drag dislocation glide might be the active mechanism during superplastic kind of deformation. Post deformation microstructure suggesting that cavitation at the sigma phase-matrix interface is the failure mechanism during high temperature deformation. Finally, high temperature properties of the present alloy will be compared with the contemporary high temperature materials such as ferritic, austenitic steels, and superalloys.

Keywords : high entropy alloy, high temperature deformation, super plasticity, post-deformation microstructures

Conference Title : ICHM 2022 : International Conference on High-Entropy Materials

Conference Location : Paris, France

Conference Dates : February 17-18, 2022