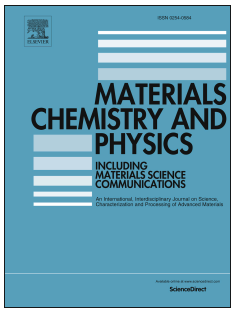


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# Phase and thermal study of equiatomic AlCuCrFeMnW high entropy alloy processed via spark plasma sintering

Devesh Kumar[1], Ornov Maulik[1], Saurav Kumar[1], Y.V.S.S.Prasad[1], Vinod Kumar[1,2,*]
[1]Department of Metallurgical and Materials Engineering, Malaviya National Institute of Technology, Jaipur-302017
[2]Department of Metallurgy Engineering and Materials Science, IIT Indore-453552 (INDIA)

**Abstract**

The present study describes the synthesis and preliminary characterization of a novel nanocrystalline equiatomic AlCuCrFeMnW high entropy alloy (HEA) via mechanical alloying (MA) followed by spark plasma sintering. A structural property of present HEA was investigated using X-Ray diffractometry (XRD), transmission electron microscopy (TEM) and selected area electron diffraction (SAED) analysis. XRD of this sintered alloy revealed the formation of ordered B2 phase (AlFe type), sigma phase (Cr rich), FeMn type phase and BCC phase. The particle morphology and composition of present HEA was investigated by scanning electron microscopy (SEM) and electron dispersive spectroscopy (EDS). Differential Scanning Calorimetric (DSC) of this alloy confirmed that there is phase transformation occurs at 918.17$^{o}$C, 925.23$^{o}$C and 936.11$^{o}$C with three different heating rates of 10 K/min, 20 K/min and 30 K/min respectively and activation energy corresponding to this transformation is 160.2 KJmol$^{-1}$. The microhardness of AlCuCrFeMnW HEA is 891 HV. The phase evolution in this alloy has been considered using thermodynamic parameters, and the structure-property relationship has also been proposed by conventional strengthening mechanisms.

**Keywords**: High Entropy Alloy, Spark plasma sintering, Transmission electron microscopy (TEM), Diffraction

* Corresponding author: Dr. Vinod Kumar (Assistant Professor; Department of Metallurgy Engineering and Materials Science; IIT Indore; India – 453552)
E-mail address: vkt@iiti.ac.in; vkt.meta@mnit.ac.in