

ROLE OF CRYSTALLOGRAPHIC ORIENTATION AND TEMPERATURE ON TRIBOLOGICAL CHARACTERISTICS OF COCRNI MEDIUM ENTROPY ALLOY

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ABSTRACT

The recent advances in materials science led to the discovery of high/medium entropy alloys (MEAs) with unique features like local chemical variation, configurational entropy, and lattice distortion [1]. These features attracted researchers to explore the properties and behavior of these complex materials. In the present study, the anisotropy in the nanoscale wear and friction characteristics of CoCrNi MEA are investigated on (100), (110), and (111) crystallographic orientations at different temperatures by experiments. To understand the deformation mechanism associated with nanoscratch in each case, corresponding three-dimensional (3D) nanoscratch molecular dynamics simulations are performed using LAMMPS. For the simulations, the interaction among the atoms in the MEA is defined by Embedded Atom Method (EAM) potential [2]. The role of chemical fluctuations in each case is understood with the help of Von Mises stress distribution, dislocations, and atomic arrangement of atoms in the respective scratch plane. The nucleation and evolution of dislocations are studied in each case by the dislocation analysis algorithm in OVITO software [3]. A correlation between the scratch plane and dislocation mechanism at different temperatures is obtained with the help of nanoscale experiments and MD simulations. The current work establishes insights into the role of chemical fluctuation on the tribological behavior of the MEA and provides an interplay between crystallography, temperature with nanoscale friction, and wear characteristics of CoCrNi MEA.

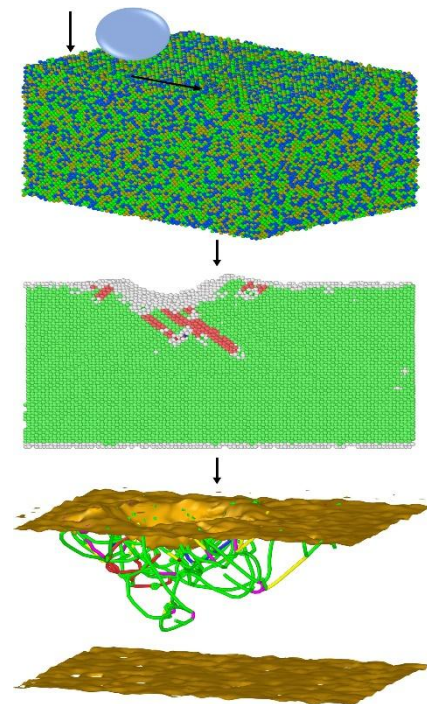


Fig.1 Atomistic model of CoCrNi and dislocation analysis.

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