# Accepted Manuscript


Influence of severe straining and strain rate on the evolution of dislocation structures during micro-/nanoindentation in high entropy lamellar eutectics

T. Maity, K.G. Prashanth, Ö. Balçi, J.T. Kim, T. Schöberl, Z. Wang, J. Eckert

PII: S0749-6419(18)30011-1

DOI: 10.1016/j.ijplas.2018.05.012

Reference: INTPLA 2355

To appear in: *International Journal of Plasticity*

Received Date: 10 January 2018

Revised Date: 15 May 2018

Accepted Date: 28 May 2018

Please cite this article as: Maity, T., Prashanth, K.G., Balçi, Ö., Kim, J.T., Schöberl, T., Wang, Z., Eckert, J., Influence of severe straining and strain rate on the evolution of dislocation structures during micro-/nanoindentation in high entropy lamellar eutectics, *International Journal of Plasticity* (2018), doi: 10.1016/j.ijplas.2018.05.012.

# Influence of severe straining and strain rate on the evolution of dislocation structures during micro-/nanoindentation in high entropy lamellar eutectics

T. Maity[1,*], K.G. Prashanth[2,3,4**], Ö. Balçi[5], J.T. Kim[3], T. Schöberl[3], Z. Wang[6], J. Eckert[1,3]

[1]*Department Materials Physics, Montanuniversitat Leoben, Jahnstraße 12, 8700 Leoben, Austria.*

[2]*Department of Manufacturing and Civil Engineering, Norwegian University of Science and Technology, Teknologivegen 22, Gjøvik, Norway*

[3]*Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Jahnstraße 12, 8700 Leoben, Austria.*

[4]*Department of Mechanical and Industrial Engineering, Tallinn University of Technology, Ehitajate Tee 5, 19086, Tallinn, Estonia*

[5]*Department of Chemistry, Koç University, Rumelifeneri Yolu, Sarıyer, Turkey*

[6]*School of Mechanical and Automotive Engineering, South China University of Technology, Guangzhou 510640, China*

## ABSTRACT

Eutectic high entropy composites (EHECs) can exhibit an excellent combination of high strength and high ductility; however, the mechanisms responsible for the strength-ductility trade-off remain unpredicted. The influence of strain rate ($\dot{\varepsilon}$) on the severe deformation imposed by high-pressure torsion (HPT) was used to evaluate the deformation mechanisms for a series of $CoCrFeNiNb_x$ ($x$ molar ratio, $0 \leq x \leq 0.80$) EHECs. Systematic and detailed micro-/ nanoindentation investigations were performed and the results suggest that strain hardening (Taylor hardening) and grain-boundary strengthening (*H-P* strengthening) are the predominant strengthening mechanisms. Nanoindentation at different loading conditions (varying $\dot{\varepsilon}$) revealed that the measured hardness in the eutectic regime increases gradually because of dislocation-lamellae-interface interactions. Based on the deformation mechanisms operating at different