ICCES, 2023, vol.27, no.3
DOI: 10.32604/icces.2023.010116

PROCEEDINGS

Damping Properties in Gradient Nano-Grained Metals

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ABSTRACT

Applications such as aircrafts and electronic devices require the noise and vibration reduction without much extra burden, such as extra damping systems. High damping metallic materials that exhibit the ability to dissipate mechanical energy are potential candidates in these application via directly being part of the functional components, such as the frame materials. The energy damping in polycrystalline metals depends on the activities of defects such as dislocation and grain boundary. However, operating defects has the opposite effect on strength and damping capacity. In the quest for high damping metals, maintaining the level of strength is desirable in practice. In this work, we reveal through atomistic simulations that the gradient nano-grained metals exhibit enhanced damping capacities compared with the homogeneous counterparts [1]. The property can be attributed to the long-range order of GB orientations in gradient grains, where shear stresses facilitate GB sliding. Without compromise the mechanical properties, the gradient structure achieves a strength-ductility-damping synergy. The results provide promising solutions to the conflicts between mechanical properties and damping capacity in polycrystalline metals.

KEYWORDS

Damping capacity; gradient nano-grained metals; grain boundary sliding; molecular dynamics

Funding Statement: The authors received no specific funding for this study.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

References

1. Qian, S., Ni, Y., Gong, Y., Yang, F., Tong, Q. (2022). Higher Damping Capacities in Gradient Nano-grained Metals. *Nano Letters, 22*, 1491-1496.