COMPUTING & MATERIALS FRONTIERS

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Publications

1. R. Su, D. Neffati, Q. Li, S. Xue, J. Cho, J. Li, J. Ding, Y. Zhang, C. Fan, H. Wang, Y. Kulkarni, X. Zhang, Ultra-high strength and plasticity mediated by partial dislocations and defect networks: Part I: Texture effect, Acta Materialia, 185, 181 (2020).

2. J. Ding, D. Neffati, Q. Li, R. Su, J. Li, S. Xue, Z. Shang, Y. Zhang, H. Wang, Y. Kulkarni, X. Zhang, Thick grain boundary induced strengthening in nanocrystalline Ni alloy, Nanoscale,11, 23449 (2019).

3. D. Chen, and Y. Kulkarni, Atomistic modeling of grain boundary motion as a random walk, Physical Review Materials, 2, 093605 (2018).

4. F. Hammami and Y. Kulkarni, Rate dependence of grain boundary sliding via time-scaling atomistic simulations, Journal of Applied Physics, 121, 085303 (2017).

5. D. Chen, and Y. Kulkarni, Entropic interaction between fluctuating twin boundaries, Journal of the Mechanics and Physics of Solids, 84, 59 (2015).

Dr. Kulkarni received her Bachelor's degree from Indian Institute of Technology in Bombay, India, and her Ph.D. in Applied Mechanics from Caltech. She was a postdoctoral scholar at University of California San Diego before joining the Cullen College of Engineering (CCOE) as an Assistant Professor in 2009. She has been the recipient of the DARPA Young Faculty Award (2010), the W.T. Kittinger Teaching Excellence Award by Cullen College of Engineering (2016), and the ASME Sia Nemat-Nasser Early Career Award (2017). She is also an Associate Editor of the Journal of Applied Mechanics. At the CCOE, her research interests focus on atomistic simulations and multi-scale modeling of material response. Select research topics of her group include elucidating deformation mechanisms in nanostructured materials for novel structural applications, statistical mechanics of interfaces, and time scaling approaches in atomistic simulations.

HIGH-STRENGTH HIGH-DUCTILITY MATERIALS

Although the nineties witnessed an intensity of research on nanocrystalline metals due to their ultra-high strength, the early enthusiasm was dampened by the discovery that the gain in strength is accompanied by a concomitant loss of grain stability and increase in brittleness. In sharp contrast, research over the past few years has provided compelling evidence that a novel classes of materials known as nanotwinned materials, may be the optimal motifs for the design of both high-strength and high-ductility materials. These discoveries have opened avenues for next-generation structural applications ranging from nuclear power systems to biomedical implants. Dr. Kulkarni's group innovates in computational modeling to design novel high-strength and high-ductility materials based on nanotwinned structures and metallic multilayers **(Figs. a-c)**

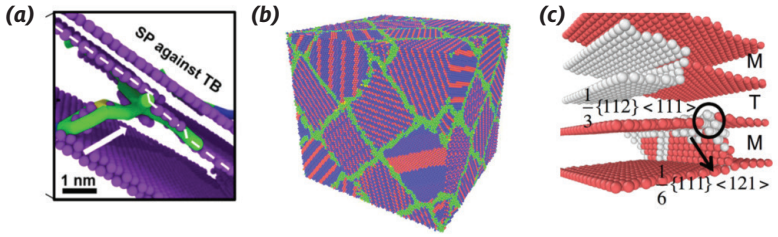

Figure (a) *shows a Shockley partial dislocation (SP) arrested by a twin boundary (TB) leading to ultra-high strength of nanopillars.* ***Figure (b)*** *shows an atomistic digital specimen of nanocrystalline Copper showing different interfaces:grain boundaries (green) and twin boundaries (red), Their synergy leads to high strength and high ductility.* ***Figure (c)*** *shows blunting of a crack tip (white atoms) on a twin boundary (red atoms) indicating ductile behavior.*

RESEARCH COMPUTING

As the Director of Research Computing in the CCOE, Dr. Kulkarni's role is to promote and facilitate the use of high performance computing and data science in research and education across all disciplines within the Cullen College of Engineering. Her plans are to coordinate, expand and enhance the CCOE Information Technologies (IT) research infrastructure in partnership with the Hewlett Packard Enterprise Data Science Institute (HPE-DSI) at the University of Houston. Dr. Kulkarni is director for two academic programs of excellence in this domain: the Masters degree in Engineering Data Science and the Engineering Data Science Certificate program. More information about these programs can be found at: ***http://researchcomputing.egr.uh.edu/***

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