Department of
Mechanical Engineering
The University of Hong Kong

DEPARTMENT OF MECHANICAL ENGINEERING
THE UNIVERSITY OF HONG KONG

SEMINAR

The Influence of Dislocation-Solute Inelastic Interactions on Materials' Mechanical Properties

Date: August 31, 2023 (Thursday)
Time: 3:30 pm
Venue: Tam Wing Fan Innovation Wing Two
G/F, Run Run Shaw Building, HKU

Speaker: Professor Qian YU
Center of Electron Microscopy and State Key Laboratory of Silico Materials,
School of Materials Science and Engineering, Zhejiang University

Abstract:

Inelastic interactions between dislocation cores and other crystal defects are critical factors in modifying materials' strength and plastic deformation. However, due to the complexity of dislocation core structures and severe distortions there, scientific understanding of these interactions remains incomplete. This is especially true when heterogeneous structures (clusters, short-range ordering, precipitates, etc.,) are present in materials, making the contribution of non-elastic interactions to materials' mechanical properties even more significant. Using multi-scale and in-situ transmission electron microscopy characterizations, combined with three-dimensional tomography and simulations, we reveal the influence of three typical types of heterogenous structure in enhancing the inelastic strain energy of dislocations. In complex alloy system, we found the existence of nanoscale compositional fluctuations, which plays important role in tuning dislocation behaviors. A new strengthening model was built accordingly. In micro-alloying system, certain alloying elements prefer to segregate at dislocation cores, intensifying the inelastic interactions between solutes and dislocations and resulting in abnormal dislocation strengthening. In multi-phase system, we reveal a non-classical nucleation mechanism in solid-state phase transformations, based on unique elemental diffusion behavior. This can create novel nano-sized heterogenous phase structure, which shows strong inelastic interaction with dislocations, significantly enhancing materials' strength and/or plasticity.

Biography:

Yu earned her PhD degree in materials science and engineering from University of California at Berkeley in 2012. She was a postdoctoral researcher at National Center for Electron Microscopy at Lawrence Berkeley National Lab from 2012 to 2014. She joined the faculty of the Center for Electron Microscopy at Zhejiang University in 2014, where she is also a professor in the Department of Materials Science and Engineering. Yu is interested in materials characterization.

Specifically, her research interests focus on applying in-situ and multi-scale electron microscopy techniques to probe into the correlations between structure and properties of materials. Her research work has been published in Nature, Science, Nature Materials, Nature Communications, etc,. She got China National Science Fund for Distinguished Young Scholars, China Youth Science and Technology Award, China Young Female Scientist Award, Second Prize of National Natural Science Award, etc,. Qian gave more than 30 invited presentations in international conferences including MRS, TMS and M&M. Her current interest is in titanium alloys and high entropy alloys.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. M.X. Huang at 3917 7906.