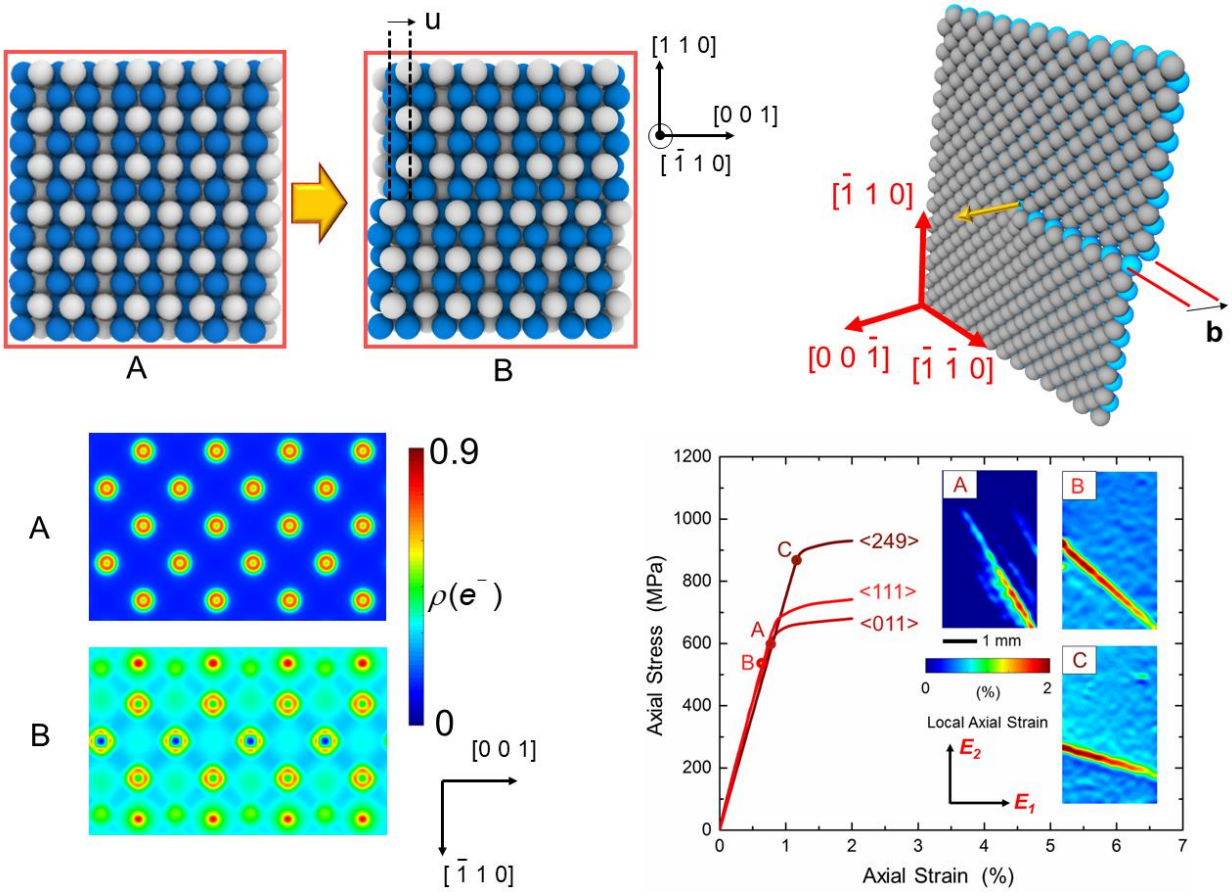
Non-Schmid slip behavior in shape memory alloys

ABSTRACT

The plastic deformation mechanisms degrading the functional properties of ordered shape memory alloys will be discussed. In particular, tension-compression slip asymmetries and anisotropic glide resistances will be interrogated on both experimental and theoretical grounds for NiTi alloy. The interplay between the atomistic scale dislocation core displacements and the applied stress tensor components will be demonstrated to play a decisive role in the deviations from the critical resolved shear stress rule, also known as non-Schmid effects. The theoretical predictions will be compared with the experimental glide resistance measurements on single crystals within the framework of high magnification *in-situ* Digital Image Correlation (DIC) technique. Physical insights from the electronic structure will be provided to build a comprehensive understanding on the underlying mechanisms for non-Schmid behavior. The theoretical and experimental anisotropic glide resistance levels will bridged to the macro-scale crystal plasticity models by generating generalized yield surfaces which can embrace the dislocation core - applied stress tensor interactions.



Short Bio:

Sertan Alkan received B.S. (2010) and M.S. (2013) diplomas from Department of Mechanical Engineering at Bogazici University. He is currently a PhD. student in Mechanical Science and Engineering Department at University of Illinois at Urbana-Champaign. During his M.S., he worked on modelling mechanical response of edge cracks in shape memory alloys particularly focusing on the martensitic transformation induced toughening. His PhD. studies involve characterization of fatigue crack growth behavior in nanotwinned Ni-Co alloys via Digital Image Correlation (DIC) technique and establishing a multiscale (continuum and atomistic) theoretical model encompassing the interaction of the crack-tip emitted dislocations with the grain and twin boundaries. Currently, his research mainly focuses on characterization of the slip mediated plasticity and twinning in shape memory alloys and high entropy alloys via DIC technique and atomistic scale simulations within the framework of Density Functional Theory and Molecular Dynamics/Statics.