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Advanced STEM Characterization of Solute Clusters, Precipitates and Solute Segregation in Light Alloys

Prof Jian-Feng Nie, PhD
Department of Materials Science and Engineering, Monash University, Vic. 3800, Australia

Abstract:
Solute clustering, precipitation and solute segregation often occur in light alloys of magnesium, aluminium and titanium, and their occurrence can strongly affect microstructure evolution and deformation behaviour of the alloys. Solute clusters may provide stronger strengthening effects than individual solute atoms and therefore have stronger influence on plastic deformation, in addition to their role in precipitate nucleation. Solute segregation can influence thermodynamic and kinetic features of an interface boundary. While such phenomena have been known for a long time, they are still not well understood at the atomistic level, and a key reason for this is the lack of atomic-scale experimental observations on the precise distribution of solute atoms in the clusters, nano-scale precipitates and the segregation. It is for this reason that the precise roles of micro-alloying elements in microstructure evolution remain speculative. Advances in aberration-corrected scanning transmission electron microscopy (STEM) in the past 20 years provide opportunities for detecting segregated solute atoms and solute clusters at the atomic scale and to reveal the precipitate formation mechanisms when these techniques are combined with atomic-scale computations. This

All are welcome!