DE LA RECHERCHE À L'INDUSTRIE

Séminaire

Vendredi 21 novembre 2014 à 10h30

Salle de réunion du SRMP – Bâtiment 520 - Pièce 109

Multi-scale description of super-saturated ferrite in severely deformed pearlitic wires

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Severely plastically deformed pearlitic wires are the strongest structural materials with up to 7 GPa ultimate strength. Despite extensive research the fundamental mechanisms underlying the extraordinary strength are still unclear. Experimental evidence suggests that the applied strain induces a substantial cementite decomposition, resulting in a dramatically increased C concentration in the ferrite matrix which is 9 orders of magnitude above phase diagram predictions.

We aim at solving the discrepancy by developing a multi-scale approach to study the stability of the bulk phases including the relevant point defects and their interaction with elastic strain, dislocations, and interfaces. Our approach combines density functional theory calculations, embedded atom potential techniques, and empirical thermodynamic models. A careful analysis reveals that a strain-induced stabilization of the C interstitial in ferrite in conjunction with a stabilization of the C trapping sides around dislocations enhance the carbon solubility strongly. Based on this insight we are able to explain the experimentally observed super-saturation of ferrite and the partial dissolution of cementite in severely plastically deformed pearlitic wires.

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