PORTEVIN-LE CHATELIER EFFECT STUDIED AT SMALL SCALE

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Portevin-Le Chatelier (PLC) effect [1] manifests itself as a serrated flow in the stress-strain curve associated with the phenomenon of dynamic strain aging (DSA), which arises from the interaction between solute atoms and matrix dislocations. The overwhelming majority of the data available in the literature about PLC effect is conducted at macro scale, often with a large and complicated microstructure. The PLC effect studies at small scale, the fundamental studies, could offer great insights to the dislocation theory of plasticity. Here we study the PLC effect in an Al-Cu diffusion couple using in situ strain rate jump micro-pillar-compression technique [2] facilitated with focused ion beam (FIB) machining. The deformed microstructures are characterize using high-resolution SEM images. Transmission electron microscopy (TEM) is used to study the atomistic origin of the DSA.

References

[1] A. Portevin, F. Le Chatelier, Comptes Rendus de l'Académie des Sciences Paris, 176 (1923) 507-510.
[2] G. Mohanty, J.M. Wheeler, R. Raghavan, J. Wehrs, M. Hasegawa, S. Mischler, L. Philippe, J. Michler, Philosophical Magazine, 95 (2015) 1878-1895.