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Creation of low-energy twin lamellae for thermal stability in nanostructured materials CHRISTOPHER SALDANA, TEJAS MURTHY, Purdue University, RAVI SHANKAR, University of Pittsburgh, SRINIVASAN CHANDRASEKAR, ERIC STACH, Purdue University — Intrinsic thermal instability of nanostructured metals have limited the applicability of these high-strength material systems. A novel stabilization route was discovered in these fine-grained systems when a high-density twin nano-lamella was introduced amongst nano-grain boundaries through SPD at cryogenic temperatures. The stabilization in such a composite microstructure was traced to the peculiar kinematic behavior of the twin-grain boundary triple junction. Copper was chosen as model material and deformed under cryogenic conditions using machining with varying deformation rates. The microstructure was investigated through HREM as a function of time and temperature. At small deformation rates, the SPD at cryogenic temperatures resulted in the creation of a nanostructured material with an unstable microstructure that coarsened even at room temperatures. At higher deformation rates under the same conditions, distribution of twin lamellae resulted in a thermally stable nanostructured material.

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