DISLOCATION AND DISLOCATION FORESTS IN 2ML Cu/Ru(0001)

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The interaction of a single dislocation with a dislocation forest is a basic problem in plasticity and dislocation behavior [1]. The problem is quite difficult to analyze both theoretically and experimentally. We report a thin film system where the dislocation structure is know in such detail that it allows a study of dislocation interaction with well defined dislocation forests through measurements of domain evolution in real time.

The system studied, 2ML Cu/Ru(0001), presents three equivalent rotational domains formed by parallel Shockley dislocations at the Cu/Ru interface (see Fig. 1, [2]). Threading dislocations emerge only at the boundaries between rotational domains with a well defined geometry. Twin-like domains are also present with Shockley partial dislocations between the two Cu layers. We present a Low Energy Electron Microscope study of the evolution of the twin-like domains (see Fig. 2). It will be shown that at temperatures where the rotational domains do not change much, the twin-like domains evolve rapidly in a very specific way: the Shockley partial dislocations that bound the twin-like domains move very fast when moving within a single rotational domain, while they slow down when crossing the threading dislocations at the edges of the rotational domains. Atomistic simulations based on semiempiric potentials will provide further insight into the experimental observations.

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[2] J. de la Figuera, A.K. Schmid, K. Pohl, N.C. Bartelt, y R.Q. Hwang, *Phys. Rev. B* **63**, 165431 (2001).

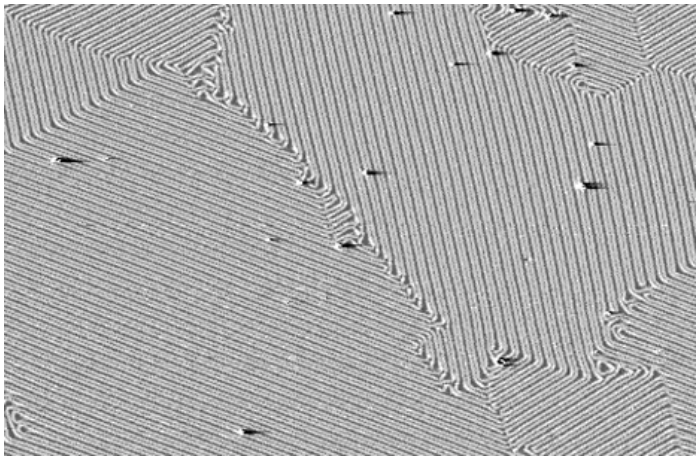

Fig. 1: 265 nm wide STM image of 2ML Cu/Ru(0001). The light gray stripes correspond to Shockley partial dislocations located at the Cu/Ru interface. Note how the dislocations at the three different rotational domains are connected at the borders.

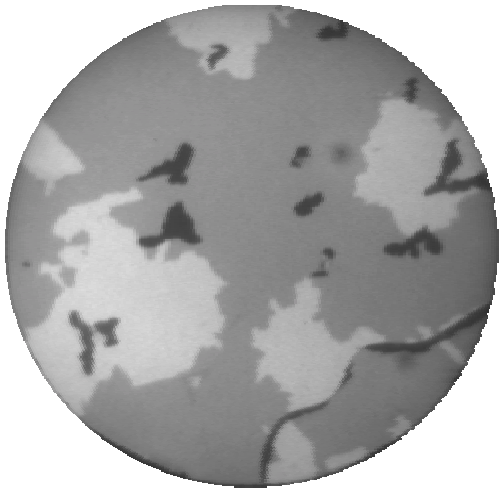

Fig. 2: 15 μm field-of-view LEEM image of a real-time movie obtained using bright-field mode. The electron energy is 40 eV. The white and grey areas correspond to the two different twin-like domains of 2ML Cu/Ru. The darker areas are 3ML regions.