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A theoretical measure for deformation twinning in FCC metals
NOAM BERNSTEIN, Naval Research Laboratory, ELLAD TADMOR, Technion - Israel Institute of Technology — The factors that control plasticity in ductile crystals are not well understood. For example the competition between slip (dislocation motion) and deformation twinning is usually quantified by its empirically observed correlation with the stacking fault energy. However, experimental measurements show significant scatter from this correlation, and materials such as Al fail to follow the nominal trend. We describe a theoretical measurement for the tendency of a material to deformation twin in terms of parameters that can be computed atomistically. We use a quantum-mechanical tight-binding method to compute this twinnability parameter for 8 fcc metals. The ordering of these materials by twinnability agrees with available experimental evidence. Our physically motivated, atomistically based criterion allows us to explain the low incidence of deformation twinning in Al, and predicts that Pd should twin as easily as Cu.

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