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Analytical calculation of energy barrier for dislocation nucleation from a crack tip SERGIO PICOZZI, George Washington University, ROBIN SELINGER, Kent State University — In a ductile material a crack subjected to a subcritical applied load may respond by emitting dislocations via thermal activation. Computer simulations show the activation energy to be strongly dependent on the applied stress. To understand this result we use conformal mapping techniques to analyze the interaction of a straight screw dislocation with a parallel crack in a strip geometry. The energy barrier for dislocation escape from the crack tip is calculated explicitly and it is found to be a sensitive function of the applied stress, in qualitative agreement with simulation results. Scaling properties of the activation energy are also determined. This analytical result permits us to formulate hypotheses regarding the factors controlling the observed strain rate. To test such hypotheses we finally calculate the strain rate as a function of temperature and applied stress and compare our results with observations.

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