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Explanation of the discrepancy between the theoretical and experimental yield stresses in bcc metals ROMAN GROGER, VACLAV VITEK, University of Pennsylvania, Department of Materials Science and Engineering — We propose a mesoscopic model that is capable to explain the factor of 2 to 3 discrepancy between experimentally measured low-temperature yield stresses of bcc metals and those typically determined by atomistic simulations of an isolated screw dislocation. The model suggests that the reason for this discrepancy is that in reality the glide of the screw dislocations is cooperative, as commonly observed at low and intermediate temperatures. In this case the stress needed to move the most highly stressed screw dislocation in an array of dislocations and simultaneously operate a dislocation source is estimated to be about a factor of 2 to 3 lower than the Peierls stress of an individual screw dislocation. Since the above-mentioned discrepancy has been encountered not only in bcc metals but also, for example, for the prism slip in hexagonal crystals, the proposed model is likely to hold more generally.

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