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Title: Applications of the dislocation dynamics method to irradiation hardening in metals.

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Irradiation hardening is one of many materials degradation processes that appear as a consequence of exposure to energetic particle radiation. At its fundamental level, irradiation hardening is related to the interplay between in-grown dislocations and irradiation defects. Dislocation behavior must be represented by models that capture the long-range nature of their interactions. However, irradiation defects are of atomistic nature and can be described by methods with spatial locality. Owing to this dislocation-defect duality, methodologies capable of studying irradiation hardening must be capable of representing spatial scales that range from a few Angstrom to up to a micron. Here we present studies of irradiation hardening in Cu and Fe using a combination of atomistic and dislocation dynamics simulations. The interconnections between the atomistic and meso scales will be discussed and comparisons with experiments provided.