Theoretical Approach to Kinetics of Transient Plasticity of Metals under Irradiation

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Abstract : Within the framework of the obstacle radiation hardening and the dislocation climb-glide model a theoretical approach is developed to describe peculiarities of transient plasticity of metal under irradiation. It is considered nonlinear dynamics of accumulation of point defects (vacancies and interstitial atoms). We consider metal under such stress and conditions of irradiation at which creep is determined by dislocation motion: dislocations climb obstacles and glide between obstacles. It is shown that the rivalry between vacancy and interstitial fluxes to dislocation leads to fractures of plasticity time dependence. Simulation and analysis of this phenomenon are performed. Qualitatively different regimes of transient plasticity under irradiation are found. The fracture time is obtained. The theoretical results are compared with the experimental ones.