Nanostructured surfaces

A study external noise-induced effects in processes of voids growth

Anna I. Bashtova, Dmitrii O. Kharchenko, Vasyl O. Kharchenko,

Institute of Applied Physics, National Academy of Sciences of Ukraine, 58 Petropavlovskaya St., 40000 Sumy, Ukraine
E-mail: anna29bashtova@gmail.com

We study properties of voids growth dynamics in a stochastic system of point defects in solids under nonequilibrium conditions (sustained irradiation). In this work we consider a problem of void size growth within the framework of the reaction rate theory by including stochastic effects of defects production. The main goal is to describe external noise-induced effects in processes of voids growth. It is shown that fluctuations of defect production rate (external noise) increase the critical void radius comparing to a deterministic system. An automodel regime of void size growth in a stochastic system is studied in detail. Considering a homogeneous system, it is found that external noise does not change the universality of the void size distribution function; the mean void size evolves according to classical nucleation theory. The noise increases the mean void size and spreads the void size distribution. Studying dynamics of spatially extended systems it was shown that vacancies remaining in a matrix phase are able to organize into vacancy enriched domains due to an instability caused by an elastic lattice deformation. It is shown that dynamics of voids growth is defined by void sinks strength with void size growth exponent varying from 1/3 up to 1/2.