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SYNTHESIS OF METASTABLE ALLOYS BY ION MIXING IN THE  
BINARY METAL SYSTEMS AND THEORETICAL MODELLING

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ABSTRACT

(1) The metastable crystalline (MX) phases formed by ion mixing (IM) are classified into 5 types, i.e. the super-saturated solid solutions and the enlarged HCP-I phases reported earlier, and the newly observed FCC-I phases in hcp-based alloys, the FCC-II and HCP-II phases in bcc-based alloys. The growth kinetics of the MX phases is discussed, (2) The interfacial free energy in the multilayered films was found to play important role in IM induced amorphization. By adding sufficient interface, amorphous alloys were obtained even in the systems with rather positive heat of formation, (3) Gibbs free energy diagrams of some representative systems were constructed, by calculating the free energy curves of all the competing phases, Steady-state thermal annealing was conducted and the results confirmed the relevance of the constructed diagrams, which were in turn employed to interpret the MX phase formation as well as the glass forming ability upon IM in the binary metal systems.