REDUCTION OF RADIATION DAMAGE IN EQUIATOMIC MULTICOMPONENT ALLOYS

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The increasing energy demand and accelerated development of new fission and fusion reactor concepts require new materials with good mechanical durability and significantly improved radiation resistance. Recently a new class of metallic alloys, so called equiatomic multicomponent alloys, were shown to have promising mechanical, electrical and magnetic properties. However, limited research on their radiation resistance has been conducted. We show here, using a combination of experimental and modeling methods, that equiatomic NiFe and NiCoCr alloys in the FCC structure retain their crystal structure under irradiation. Moreover, we observe that the accumulated damage in NiFe and NiCoCr alloys is a factor of 2 - 3 lower than in the corresponding pure Ni. Reduced dislocation mobility, as a key controlling factor, leads to slower growth of large dislocation structures. These results show that designed chemically complex, yet structurally simple concentrated alloys may emerge as a new class of radiation-resistant materials. The obtained results also encourage to search for better combinations of elements as well as other that equiatomic concentrations of the elements.