

Solid state physics problems in nuclear materials

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Abstract. Neutron irradiation and thermal ageing are known to cause embrittlement of reactor pressure vessel (RPV) steel, but the underlying microstructure processes are, in spite of large amount of research, not yet fully understood. For example, the irradiation of RPV steel creates defects and enhances the growth of various precipitates, which impede the dislocation motion, resulting in an increase of hardness, yield strength and ductile to brittle transition temperature. The main challenge is to properly model the complex interplay between interstitials, dislocations and defects and to relate these interactions to the macroscopic properties of steel. I will introduce the physics of steels, and discuss current theoretical and experimental developments.