

反应堆工程

双束 (H⁺/e⁻) 辐照下氢对12Cr-ODS铁素体钢组织损伤影响研究

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摘要 利用氢离子 (H⁺) 束和电子 (e⁻) 束双束 (H⁺/e⁻) 同时辐照用化学浸润法制备的新型12Cr-ODS铁素体钢, 研究其辐照损伤效应及组织变化。实验结果表明: 由于氧化物的钉扎, 基体内保持低密度位错网络; 辐照初期随辐照剂量的增加, 缺陷团在位错线上及其周围形成, 尺寸增加, 密度不断增大, 并形成间隙型位错环; 不同温度下辐照均产生小尺寸高密度的空洞, 随辐照剂量的增大, 空洞长大速度降低, 空洞密度缓慢减小; 不同温度下, 辐照剂量达15 dpa时, 空洞肿胀均小于0.15%。对辐照产生的点缺陷与氢相互作用进行理论分析, 12Cr-ODS铁素体钢在623~823 K经双束辐照后, 表现出良好的抗辐照损伤性。

关键词 [双束辐照](#) [化学浸润法](#) [组织损伤](#)

分类号

Effect of Hydrogen/Electron Dual-beam Irradiation on Microstructure Damage of 12Cr-ODS Ferrite Steel

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Abstract The effects of hydrogen/electron dual-beam irradiation on the microstructure damage behavior of a new 12Cr-ODS ferrite steel made by chemical soaking method was studied in this work. The results show that, at the beginning of irradiation, the dislocation networks remain in the matrix owing to the pinning of oxides; as dose increases, defect clusters start to form on/around the dislocations, their number densities get higher and sizes become larger, then the defect clusters turn into interstitial dislocation loops; the voids can form at different temperatures with high number density and small size; also with the increasing of dose, the coarsening rates of the voids slow down, and the number densities of the voids decrease slightly; with a dose of 15 dpa, all the void swellings are 0.15% smaller even at different temperatures. The 12Cr-ODS ferrite steel shows a good resistance to irradiation during the dual-beam irradiations over 623-823 K.

Key words [dual-beam irradiation](#) [chemical soaking method](#) [microstructure damage](#)

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