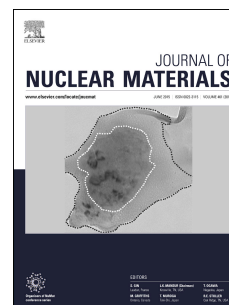


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Cyclic softening in annealed Zircaloy-2: Role of edge dislocation dipoles and vacancies

Sudhakar Rao G.^{1,2,*}, S.R. Singh³, Vladimir Krsjak⁴, Vakil Singh²

¹ *Nuclear Energy and Safety, Laboratory for Nuclear Materials, Paul Scherrer Institut, Villigen-PSI 5232, Switzerland*

² *previously at Department of Metallurgical Engineering, Indian Institute of Technology (Banaras Hindu University), Varanasi 221005, India*

³ *School of Material Science and Technology, Indian Institute of Technology (Banaras Hindu University), Varanasi 221005, India*

⁴ *Institute of Nuclear and Physical Engineering, Slovak University of Technology, Bratislava 811 07, Slovakia*

ABSTRACT

The mechanism of cyclic softening in annealed Zircaloy-2 at low strain amplitudes under strain controlled fatigue at room temperature is rationalized. The unusual softening due to continuous decrease in the phenomenological friction stress is found to be associated with decrease in the resistance against movement of dislocations because of the formation and easy glide of pure edge dislocation dipoles and consequent decrease in friction stress from reduction in the shear modulus. Positron annihilation spectroscopy data strongly support the increase in edge dislocation density containing jogs, from increased positron trapping and increase in annihilation lifetime.

Keywords: Low cycle fatigue; cyclic stress response; dislocation dipoles; zirconium alloys; positron annihilation spectroscopy

* Corresponding Author: G. Sudhakar Rao, sudhakar-rao.gorja@psi.ch

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