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Effect of low hydrogenation on the low-cycle fatigue of zirconium alloy

S.A. Nikulin, A.B. Rozhnov, T.A. Nechaykina,

S.O. Rogachev*, M.Yu. Zadorozhnyy, Khanan Alsheikh

The National University of Science and Technology “MISIS”, Leninsky pr. 4, 119049 Moscow,
Russia

*Corresponding author. Tel.: +7 495 955 00 89; fax: +7 495 230 46 22;

e-mail: csaap@mail.ru

Abstract. The comparative low-cycle fatigue tests of small-sized flat E110 zirconium alloy samples (hydrogenated and non-hydrogenated) at room temperature using a dynamic mechanical analyzer have been carried out. It is shown that the presence of hydrogen in E110 alloy with a mass fraction up to 0.02% has a positive effect on the fatigue resistance of samples oriented transversely to the rolling direction and does not affect the fatigue resistance of the samples oriented along the rolling direction. The mechanisms of the fatigue crack propagation in hydrogenated samples with different orientation of hydrides are proposed.

Keywords: Low cycle fatigue; Zirconium alloys; Hydride; Fractography; Dynamic mechanical analyzer.

1 Introduction

The fatigue resistance of the zirconium alloys as well as other important operational properties, such as radiation growth and creep, resistance to uniform, local corrosion and hydrogenation is an important characteristic that determines the reliability of the elements of fuel assemblies (FA) in nuclear reactors.

Today, there is a need to create zirconium alloys which can provide the planned loads in the reactors during a service life of up to 7 years, including the conditions of maneuvering by the

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