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Hydrogen-induced Damage in Zirconium Alloys used in Nuclear Power Reactors

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Abstract

Zirconium alloys are widely used for reactor core components in Nuclear Power Plants due to their low neutron absorption cross section, corrosion resistance to high temperature aqueous environments, optimum mechanical properties and resistance to radiation damage. Hydrogen-induced damages namely, delayed hydride cracking and hydride blistering limit their life in the reactor. This paper reviews briefly the mechanisms and factors controlling these damage processes and their non-destructive evaluation.

Hydrogen induced damages viz., delayed hydride cracking and hydride blistering in Zr alloy reactor core components affect their structural integrity. Control of material characteristics and operating conditions help in minimising their detrimental influences. Periodic in-service inspection by appropriate NDT methods is required to monitor the initiation and progression of these damages. These examinations provide important inputs for structural integrity assessment of these components and help in taking decisions regarding continued safe operation of nuclear power plants.