Trade Science Inc

International Journal of Chemical Sciences

Smart behavior as cause of instability in kinetics of radiation embrittlement of the Reactor Pressure Vessel Steel

Krasikov E

Affiliation: National Research Centre "Kurchatov Institute", Russia

Abstract

Influence of neutron irradiation on reactor pressure vessel (RPV) steel degradation are examined with reference to the possible reasons of the substantial experimental data scatter and furthermore – nonstandard (non-monotonous) and oscillatory embrittlement behavior. In our glance this phenomenon may be explained by presence of the wavelike recovering component in the embrittlement kinetics. We suppose that the main factor affecting steel anomalous embrittlement is fast neutron intensity (dose rate or flux), flux effect manifestation depends on state-of-the-art fluence level. At low fluencies radiation degradation has to exceed normative value, then approaches to normative meaning and finally became sub normative. Data on radiation damage change including through the ex-service RPVs taking into account chemical factor, fast neutron fluence and neutron flux were obtained and analyzed. In our opinion controversy in the estimation on neutron flux on radiation degradation impact may be explained by presence of the wavelike component in the embrittlement kinetics. Therefore flux effect manifestation depends on fluence level. At low fluencies radiation degradation has to exceed normative value, then approaches to normative meaning and finally became sub normative. Nascent during irradiation nanostructure undergo occurring once or periodically evolution in a direction both degradation and recovery of the initial properties. According to our hypothesis at some stage(s) of metal nanostructure degradation neutron bombardment became recovering factor. So, material smart behavior is a cause of instability in kinetics of radiation embrittlement of the reactor pressure vessel steel. As a result oscillation arise that in tern lead to enhanced data scatter. For the sake of correctness it is necessary to remember that there is an example when contrary to the famous radiation embrittlement in metals neutron irradiation at some range of fast neutron doses is in position to improve both the strength and ductility of steel.

Biography

Education: Moscow Power Engineering Institute. Degree(s) or Diploma(s) obtained: Master's Degree in Material Science – 1970, Ph.D. – 1974, D.Sc. -2005. Membership of professional bodies: member of Scientific Council of RAS on Radiation Damage Physics of Solids. Years within the firm: since 1974. Key qualification: responsible executor in Radiation Damage Physics of Solids. Professional experience record: since 1974 till now, Moscow, National Research Centre "Kurchatov Institute".

Abstract Citation: Krasikov E, Smart behavior as cause of instability in kinetics of radiation embrittlement of the Reactor Pressure Vessel Steel, Smart Materials Congress 2020, International Conference on Smart Materials and Nanotechnology, July 23-24, 2020, page 4

Int. J. Chem. Sci.2020
ISSN: 0972-768X

Volume 18 Issue 5 | 04