

**Title:** Interaction of Hydrogen with Nanoscale Structures in Irradiated Steel

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**Abstract:**

As the service life of an operating nuclear power plant (NPP) increases, the potential misunderstanding of the degradation of aging components must receive more attention. In essence, the reactor pressure vessel (RPV) is the key structural component of the NPP that determines the lifetime of nuclear power plants. Environmentally induced cracking in the stainless steel corrosion-preventing cladding of RPV's has been recognized to be one of the technical problems in the maintenance of light-water reactors. Therefore, in the case of cladding failure, the problem arises of hydrogen (as a corrosion product) embrittlement of irradiated RPV steel because of exposure to the coolant. The effects of neutron fluence and irradiation temperature on steel/hydrogen interactions (adsorption, desorption, diffusion, mechanical properties at different loading velocities, post-irradiation annealing) were studied. Hydrogen accumulation analyses and thermal desorption investigations were performed to prove the evidence of hydrogen trapping at irradiation defects. Extremely high susceptibility to hydrogen embrittlement was observed with specimens which had been irradiated at relatively low temperature. Our study on radiation-hydrogen embrittlement of the steel raises the question concerning the unknown source of hydrogen that was discovered in our experiments. It is necessary to look for this source of hydrogen especially because hydrogen flakes were detected in reactor vessels of Belgian NPPs. As a possible initial hypothesis about the enigmatical source of hydrogen one can propose protons generation during beta-decay of free neutrons inasmuch as protons detected by researches at nuclear

reactors as witness of beta-decay of free neutrons.

**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", Department: Reactor Materials and Technologies Institute.

**Speaker Publications:**

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