

Does neutron displacement damage really matter in irradiation accelerated corrosion?

Monday 9 September, 13:30, F41 Sackville Street Building

Abstract:

Irradiation Accelerated Corrosion (IAC) is a well-known effect in nuclear reactors, but there are basic questions about the phenomenon which have never been answered. The importance of aqueous electrochemical corrosion potential, and its dependence on the radiation field, has been amply demonstrated, but there has been no clear assessment of the relative importance of displacement damage from the high energy neutrons. In this work, thin stainless steel and zirconium samples have been irradiated with 1.5-2.5 MeV electron beams at the Notre Dame Radiation Lab, and with 3.2 MeV proton beams at the University of Michigan

Ion Beam Laboratory. In both cases the beam passes through the metal into water held at PWR conditions (3ppm H₂ and 320oC), where radiolysis generates corrosive OH radicals and hydrogen peroxide as in a reactor. The experiment is designed to match the dose rate at the oxide surface for the two charged particle types of very different LET. Only in the case of the proton beam is there simultaneous displacement of the atoms in the metal lattice. After 1-3 days of exposure the oxide films are examined by various optical and electron microscopy techniques. Comparison of the proton and electron beam results suggests that water radiolysis dominates the IAC mechanism(s) in most cases.

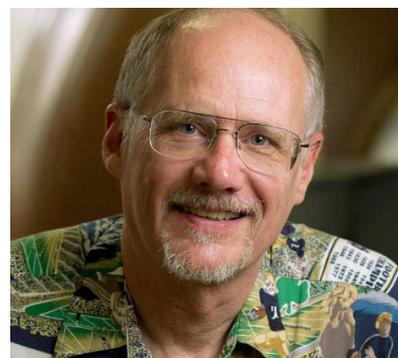
Speaker: David Bartels, Radiation Laboratory, Notre Dame University, Notre Dame, Indiana, USA

2003-present: Notre Dame Radiation Lab

1985-2003: Argonne National Lab

1982: Ph.D., Northwestern University

Research interests: Fast kinetics of free radical reactions; radiation chemistry and photochemistry of water; solvent effects on reaction rates in supercritical water



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For info contact ben.gardner@manchester.ac.uk