Conférence du Réseau CEA Radiolyse

Radiolysis of Water from Ambient to High Temperatures in the Aspect of Hydrogen Generation

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Dorota Swiatla-Wojcik

Institute of Applied Radiation Chemistry
Faculty of Chemistry, Lodz University of Technology, Poland

Abstract

A short review of the mechanisms of hydrogen generation from radiolysis of water is presented for conditions ranging from ambient to high temperatures. Factors affecting the hydrogen generation include the type of radiation, the linear energy transfer (LET) of the radiation and the physical conditions of pressure and temperature. An understanding of radiation chemistry of high temperature water is important to maintain integrity and safety of water-cooled nuclear power reactors. Exposition of the coolant to fast neutrons and gamma rays, at ca. 320 ^{o}C, generates transient radiolytic species, which finally form stable molecular products: H_2 and corrosive O_2.

Computational methods closely integrated with measurements provide qualitative and quantitative insights into the radiation-induced chemistry at different time scales replacing difficult or dangerous experiments in severe environment. An overview of computing capability of the hybrid method proposed for numerical modelling of radiation-induced chemistry of the cooling water is also presented. Significant sensitivity to the rate constant of the reaction $H^{\bullet} + H_2O \rightarrow {}^{\bullet}OH + H_2$ on the calculated steady-state concentrations of O_2, H_2O_2, and H_2 is discussed.

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