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Arjun Pradeep, Anil Kumar Sharma

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Semi-empirical model for wet scrubbing of bubble rising in liquid pool of Sodium-cooled Fast Reactor

Arjun Pradeep, Anil Kumar Sharma†

Indira Gandhi Centre for Atomic Research, HBNI, Kalpakkam, Tamil Nadu, India

† Corresponding author: e-mail: aksharma@igcar.gov.in, Tel. (+91 44) 27480500-23465

Fax (+91 44) 27480195

ABSTRACT

Mechanistic calculations for wet scrubbing of aerosol/vapor from gas bubble rising in liquid pool are essential to Sodium-cooled Fast Reactor (SFR) safety. Hence, scrubbing of volatile fission product from mixed gas bubble rising in sodium pool is presented in this study. To understand this phenomena, a theoretical model has been setup based on classical theories of aerosol/vapor removal from bubble rising through liquid pools. The model simulates pool scrubbing of sodium iodide aerosol and cesium vapor from a rising mixed gas bubble containing xenon as the inert species. The scrubbing of aerosol and vapor are modeled based on deposition mechanisms and Fick's law of diffusion respectively. Studies were performed to determine effect of various key parameters on wet scrubbing. It is observed that for higher vapor diffusion coefficient in gas bubble, the scrubbing efficiency is higher. For aerosols, the cut off size above which the scrubbing efficiency becomes significant was also determined. The study evaluates the retention capability of liquid sodium used in SFR for its safe operation.

Keywords: *bubble; wet scrubbing; mass transfer; SFR safety; aerosol*