TITLE

Isotope exchange on surface of lithium silicate produced by spraying method

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PAPER

Lithium orthosilicate is one of the promising candidates of fusion reactor blankets with solid breeder materials. KIT (Karlsruhe Institute of Technology) has developed a production route, in which a high temperature spraying technique is applied, for lithium orthosilicate from lithium hydroxide. Hitherto, the authors performed out-of-pile release experiments of trithium on the lithium orthosilicate materials. For deep understanding of release behavior of tritium from the lithium orthosilicate materials, various mass transport processes related to release of tritium should be thoroughly studied. Among the mass transfer processes, the surface phenomena play a key role in the migration of tritium in ceramic breeder materials. With regard to such surface phenomena, the rates of adsorption and isotope exchange reactions on the surface need to be quantified for design of fusion blankets and numerical process simulation of the fuel cycle of fusion reactors.

In this work, the authors investigated isotope exchange reactions on the surface of the lithium orthosilicate material using proton and deuterium. In the experiments of this work, mixture gases containing hydrogen and heavy water vapor were introduced to packed beds of the lithium orthosilicate material and the concentration of hydrogen, deuterium, water vapor and heavy water vapor were measured using a gas chromatograph and a mass spectrometer. The adsorption amount of water vapor on the lithium orthosilicate material was experimentally examined, as well. The experimental data in these ways were analyzed using theoretical mass balance equations. The rates of isotope exchange reactions were expressed as a function of concentrations hydrogen isotopes in the gas phase and on the surface phase, and rate constants were quantified as a function of temperature.