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[P17] Study of thermal scattering law of hydrogen in water with analysis of TCA critical experiments

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From a number of the critical experiments performed at the Tank-type Critical Assembly (TCA), a series of experiments proper to validation of S(α, β) was selected and analyzed by the continuous-energy Monte Carlo code MVP3 with JENDL-4.0. In the experiments, the critical water levels were measured changing the number of water holes in the center of the core. As a result, the calculated keff values systematically decreased along with the critical water levels. When the same analysis was performed with the free-gas-model scattering cross-section of hydrogen in place of S(α, β), the keff values increased with the critical water levels. From this fact, a slightly smaller S(α, β) was expected to cancel the decreasing trend of the keff values. Using the perturbation function of MVP3, the reactivity changes for the perturbation in the atomic number densities of hydrogen were calculated. They corresponded to the reactivity changes for the perturbation in the neutron-flux-weight total cross-sections (<Φσ>). Decreasing <Φσ> of hydrogen by about 2% almost cancel the trend. The main part of the total reaction rate of hydrogen in water is the thermal scattering. The modification of <Φσ> would be obtained by modifying S(α, β) in 10-2 to 10-1 eV.

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