GOTHIC 3D Applicability to Fast Hydrogen Combustions

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Abstract

Under severe accidents in nuclear power plant (NPP), the hydrogen can be generated by chemical reactions and may threaten the containment integrity via hydrogen combustion. For containment analyses, three-dimensional mechanistic code, GOTHIC had to be applied near source compartments in order to predict whether highly reactive gas mixture can be formed or not under hydrogen mitigation system (HMS) working. For its applicability, this paper presents numerical calculation results of GOTHIC 3D on some hydrogen combustion experiments, which are the FLAME (Sandia National Lab.) experiments, the LSVCTF (AECL Whiteshell Lab.) experiments and the SNU-2D (Seoul National Univ.) experiments. A technical basis for the modeling of the large- and small-scale facilities was developed through sensitivity studies on cell size and combustion modeling parameters. It was found that for large-scale facilities, there were no significant differences in the results with different turbulent burn options, while for small-scale facility, the option using the eddy dissipation concept showed the faster flame propagations. The flame velocity became larger with smaller burn parameters such as the flame thickness δ_f and the burn temperature limit T_{lim}. The best estimate modeling parameters found from this study would be applied to real plant simulation of GOTHIC 3D later.