

Abstract

The validation study done in this paper on the capabilities of FDS, to replicate an experiment in water cooling of a hot steel plate, has resulted in concluding that this particular CFD program is capable of producing relatively accurate results and having thus a good agreement with the experimental data. The experiment consisted of a hot metallic steel plate that was heated up, using a radiative panel, to 600 °C and then cooled with a water spray to ambient temperatures. The heating and cooling output data of the simulations are agreeing to those achieved in the similar experiments. Crucial factors for achieving these decent results were mainly the mesh size and its set-up regarding the objects implemented into the simulation, the high enough heat transfer coefficient, the correct specific heat of steel and the inclusion of water inside the steel plate. The default heat transfer coefficient between the water droplets and the hot plate for example proved to be much lower than the coefficient of the experiment and thus also much lower than the one used in the simulations to achieve the best agreeing results. The specific heat of steel used in the simulations is a very determining parameter when it comes to the heating phase of the steel plate.

Keywords— Validation study, FDS, Fire Dynamics Simulator, Surface wetting, Water spray, Boiling curve, Weber number, Coverage area