A CFD Model for the OSU Calorimeter for Rate of Heat Release Predictions[1]

Bakhtier Farouk[+] and Garrett Cappello
Mechanical Engineering and Mechanics
Drexel University
Philadelphia PA 19104

[+]Corresponding author, email: bfarouk@drexel.edu

ABSTRACT

A comprehensive three-dimensional time-dependent computational fluid dynamic model for the full-scale OSU (Ohio State University) reactor is under development using the ANSYS-Fluent code. The OSU Rate of Heat Release Apparatus and the Cone Calorimeter are the test devices that measure the rate of heat release from burning materials. While comparisons between data generated from the two instruments is found in the literature, no systematic attempt has been made to show conformity of results obtained between the two test methods. In addition, the OSU apparatus is in frequent use by the government aviation agency for measuring the rate of heat release of materials used in the interior of passenger aircrafts. There are maximum allowable values of peak heat release rate of such materials and accurate measurement of these rates is imperative. A proposed regulatory requirement and subsequent round-robin testing showed that oxygen depletion and thermal methods of measuring heat release measurements produced different values, although the two methods are generally proportional.

The present CFD model development is for the standard OSU reactor that is about 1.4 m long with a rectangular structure for flow development and burning of the specimen induced by radiant heating and pilot flames. The chimney at the top of the reactor includes cooling flow channels along the chimney wall. The validated CFD model will serve as a benchmark for providing uniformity in predictions of the OSU reactors located in different laboratories. A validated model will also provide better understanding the of the flow and heat transfer characteristics in the OSU reactor.

[1] Submitted for presentation at the *Tenth Triennial International Aircraft Fire and Cabin Safety Research Conference*, October 17-20, 2022, Resorts Casino and Hotel, Atlantic City, New Jersey, USA