COMPUTATIONAL MODELLING AND GRID INDEPENDENCE TEST OF A CFD MODEL FURNACE FOR NOX EMISSION STUDY

Kotalkara Abdul Saleem1, Dr. S Suresh2,
1MS (Thermal) Research Scholar, National Institute of Technology, Trichy
2Associate Professor, National Institute of Technology, Trichy

Mesh independence study is one of the most crucial step in any CFD simulation problem. The aim of this study is to investigate the effect of the various parameters on the simulation of a CFD model furnace of 3300 kW capacity. Herein a 3D, steady state CFD model of a furnace was developed that includes various equations that are dominant in a typical furnace i.e. mass, momentum, species, energy equations which are coupled with the combustion models. Initial simulations were carried out for obtaining the velocity and temperature profiles for the CFD model. This CFD model employs renormalized group (RNG) k-ε turbulence model, eddy dissipation reaction model, Discrete Ordinate radiation model that are solved sequentially to predict the combustion process. Then after the mesh independence for the CFD model is done using Grid Convergence Index method using velocity and temperature values for fine, medium and coarse grids. The numerical results showed that the mesh is grid independent in both the cases of velocity and temperature. Then after further numerical analysis of the CFD model were conducted for studying the NOx emission characteristics of the furnace and the effect of Flue gas recirculation (FGR) on the NOx emission at the furnace exist. After computational analysis it was found that by increasing the FGR ration from 0 to 12 %, the NOx levels were reduced by over 55% from that of base case or 0% FGR.

 ISBN 978-93-5406-579-8