THERMOFLUIDODYNAMIC SIMULATION OF PRACTICAL COMBUSTION SYSTEMS AND PREDICTION OF NO_X BY REACTOR NETWORK ANALYSIS

M. Falcitelli *, S. Pasini**, L. Tognotti***
*Consorzio Pisa Ricerche. P.zza A. D'Ancona, 1. - Pisa, Italy
**ENEL S.p.A. Produzione Ricerca. Via A. Pisano,120. - Pisa, Italy
***Università degli Studi di Pisa - Dip. di Ingegneria Chimica,
Chimica Industriale e Scienza dei Materiali - Pisa, Italy

ABSTRACT. An integrated methodology for the simulation of practical combustion systems is presented. A detailed 3D simulation of flow is performed adopting adequate CFD models for heat transfer, chemical reactions and turbulence. Then flow information is extracted from resulting CFD fields to create simplified reactor networks, for utilising detailed reaction chemistry and predicting the interconversion of the species involved in combustion. The study of two glass melting furnaces are shown as example. The furnaces were experimentally characterised, then CFD simulations were performed. From each CFD simulation, a chemical reactor network was extracted, to perform the computation of the secondary product combustion species. An evaluation of the models was given comparing the measurements with of both the temperature CFD field and the NOx prediction. A discussion of the effect of the various sub-models is presented with a special emphasis on the heat-transfer boundary conditions and combustion chemistry interaction.