Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Eulerian methods for the description of soot: mathematical modeling and numerical scheme T.T. NGUYEN, EM2C, CNRS UPR 288 - Fed. de Math., FR CNRS 3487 - ECP, France, A. WICK, Institute for Combustion Technology, RWTH Aachen University, Germany, F. LAURENT, EM2C, CNRS UPR 288 - Fed. de Math., FR CNRS 3487 - ECP, France, R. FOX, Iowa State University, USA, H. PITSCH, Institute for Combustion Technology, RWTH Aachen University, Germany — A development and comparison between numerical methods for soot modeling derived from the population balance equations (PBE) is presented. The soot mechanism includes nucleation, surface growth, oxidation, aggregation and breakage (Mueller et al., Proceed. Combust. Inst., 2009, 2011). For comparison, data from the ethylene premixed flame of Xu et al. (Combust. Flame 108, 1997) over a range of equivalence ratios are used. Two types of methods are introduced. The first is a moment method in which the closure is obtained through a reconstruction of the number density function (NDF). In particular, the NDF can be approximated by a sum of Gamma distribution functions (Yuan et al., J. Aero. Sci. 51, 2012). The second is Eulerian multi-fluid (MF), which is a size discretization method (Laurent et al., Combust. Theory Modelling 5, 2001) considering one or two moments per section. The case of one moment per section is also known as a sectional method. The accuracy of MF methods depends on the number of sections. Eventually, an extension of these two methods considering the surface area as a function of volume is taken into account to describe more precisely the geometry of soot particles. The solutions from these methods are compared with solutions from Monte Carlo method.

T.T. Nguyen
EM2C, CNRS UPR 288 - Fed. de Math., FR CNRS 3487 - ECP, France

Date submitted: 29 Jul 2014 Electronic form version 1.4