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Direct Numerical Simulation of Soot Particle Dynamics using DQMOM GUILLAUME BLANQUART, HEINZ PITSCH, Center for Turbulence Research, Stanford University, RODNEY FOX, Department of Chemical and Biological Engineering, Iowa State University — The understanding of soot particle dynamics in combustion systems is a key issue in the development of low emission engines. Of particular importance are the processes shaping the soot particle size distribution function (PSDF). However, it is not always necessary to represent exactly the full distribution but rather some of its moments. The Direct Quadrature Method of Moments (DQMOM) allows for a very accurate prediction of the moments of the soot PSDF without the cost of expensive methods like Direct Simulation Monte-Carlo (DSMC). This method has been validated for laminar premixed and diffusion flames with detailed chemistry and is now implemented in a semi-implicit low Mach number Navier-Stokes solver. A Direct Numerical Simulation (DNS) of an ethylene jet diffusion flame is performed to study the dynamics of soot particles in a turbulent environment. Soot particles are formed in very rich regions of the flames and are then transported to lean regions where they get oxidized. The time evolution of the soot PSDF will be analyzed and compared to similar distributions from laminar simulations.

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