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Role of Large Scale Mixing in Soot Evolution in Turbulent Nonpremixed Combustion MICHAEL MUELLER, Stanford University, HEINZ PITSCH, Stanford University; RWTH Aachen University — In order for soot to form and grow, long residence times are required at rich mixture fractions. Under these conditions, soot particles grow either by surface reactions with acetylene or by condensation of Polycyclic Aromatic Hydrocarbons (PAH) onto the surface of the particles. In past studies on nonpremixed combustion, condensation of PAH was found to be the dominant growth mechanism, while surface reactions with acetylene played only a minor role. In this work, a recently developed LES model for soot evolution in turbulent nonpremixed combustion is used to examine two configurations in which long residence times under rich conditions are attained in distinctly different ways. In the first configuration, a typical piloted jet flame, soot is formed far downstream from the burner nozzle and grows primarily by PAH condensation. In the second configuration, a bluff body stabilized flame, the dominant soot growth mechanism is found to be surface growth by acetylene. Here, the recirculation zone formed behind the bluff body provides the long residence times needed for soot formation. The combination of very small dissipation rates and a narrow band of mixture fractions in the recirculation zone promotes surface growth by acetylene over PAH condensation.

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