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Laser Diagnostic Methods to Characterize Soot Evolution in Diesel-relevant Fuels[1] STEVEN OVERHEIM, BRIAN FISHER, University of Alabama — Soot particles are a harmful byproduct of diesel combustion and can be detrimental to the environment and our health. The purpose of this research is to gain a better understanding of how the soot formation, growth, and oxidation are directly related to the chemical structure of the fuel in a diffusion flame. Such understanding is expected to help with soot reduction methods in the future. A new method to analyze soot concentrations was developed combining previous successful methods of experimentation. The new method employs combined elastic scattering and extinction to characterize soot formation, growth, and oxidation throughout the flame. These concentrations are quantifiable through the use of a 532-nm Nd:YAG laser and carefully calibrated photodetectors as optical measuring tools. This study focused on the doping of the diffusion flame with toluene, which has an aromatic molecular structure. The diffusion flame is doped with a low concentration of toluene, 1000 ppm, in its fuel stream and compared to a methane-fueled base flame. By comparing the doped flame to the methane/oxygen base flame, the higher level of active soot formation in the doped flame was clearly observed. Future work on the project will entail further data analysis to convert measured signals into quantitative soot size and concentration information.

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