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Influence of Temperature and Dilution on Final Soot Nanostructure JUSTIN DAVIS, IGOR NOVOSSELOV, University of Washington — Morphological evolution of nascent to mature combustion-generated particles is of interest due to changes in particle optics, chemical composition, and their effect on human health. In this work, the nanostructure of primary soot particles is investigated using argon dilution in laminar ethylene, ethane, and methane flames. A co-flow reactor oriented downwards allows for precise control on combustion conditions due to increased flame stability brought on by competing buoyant and convective forces. The dilution is varied from 0% to 90% by volume to investigate particle formation in temperature ranges from 1500 to 1950 K. High-resolution TEM displays different levels of particle maturity, from young soot with minimal order to mature particles with a core-shell nanostructure. A novel image processing algorithm helps to quantify differences in soot nanostructure, indicating the molecular weight of PAHs is similar for young and mature soot. However, molecular curvature decreases, suggesting the driving factor of soot maturity is a reduction in steric hindrance due to carbonization kinetics at high flame temperatures. These results can be used for validation of soot modeling approaches and to improve the understanding of structural changes as soot particles traverse the flame front.

Justin Davis
University of Washington

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