

Direct observation of aliphatic structures in soot particles produced in low-pressure premixed ethylene flames via online Raman spectroscopy

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Abstract

Raman spectra of soot particles were monitored in the gaseous flow extracted from the burning regions of two low-pressure premixed ethylene flames, for the first time. The flame conditions were chosen to explore the diversity of soot nanostructure in slightly sooting flames. Evaluation of the Raman spectral parameters revealed that the soot particles exhibited a strongly disordered structure and a large proportion of sp hybridization of the carbon. The appearance of sp carbon chains composing up to 30% of the total carbon content as well as an olefinic component may indicate their important role in soot nucleation and growth in low pressure ethylene flames. Hence, Raman spectroscopy of soot particles in the aerosol phase revealed that accretion and cyclization of the aliphatic carbon including sp carbon chains could thus be of importance for the initial soot growth and require more investigation.

Keywords: Raman spectroscopy; Sooting flame; Nanostructuration; PAH; Aliphatic carbon chains