Real-Time Experimental Observations of the Formation of Soot and Fullerenes in Flames and a Novel Proposal for Large-Scale Synthesis of Fullerenes and Nanotubes

Peter T. A. Reilly*, William B. Whitten and J. Michael Ramsey
Oak Ridge National Laboratory, PO Box 2008, MS 6142, Oak Ridge, TN 37831-6142

Real-time measurements of individual flameborne particles have permitted direct observation of the evolution of the carbonization process for the first time. These measurements have led to many surprising revelations regarding the evolution of soot and fullerenes in flames. During this presentation:

(1) A precise chemical description of the carbonization process will be given.
(2) Experimental evidence from our laboratory and the literature will be presented that show *huge* PAH-containing precursor particles can be produced in flames.
(3) Experimental evidence will be presented that show the PAHs in the PAH-containing particles rapidly exchange hydrogen as the result of pyrolysis.
(4) Experimental evidence will be presented that show the PAHs in the condensed phase act as a hydrogen sink.
(5) Experimental evidence will be presented that show that preferentially hydrogenated PAHs exist in the PAH-containing precursor soot.
(6) Experimental evidence will be presented that show hydrocarbon side chains don't exist on the PAHs in the PAH-containing soot.
(7) Experimental evidence will be presented that show the PAH-containing particles and mature soot aggregates have the same size distribution. Reasons for this observation will be discussed.
(8) Hydrogen exchange in the PAH-containing particles will be demonstrated to profoundly affect soot formation kinetics.
(9) A mechanism that already has existed in the literature for decades will be presented that credibly explains the reason for universal nature of soot aggregates and the transformation of micron-sized PAH-containing droplets into mature soot aggregates consisting of monodispersed nanoparticles.
(10) The chemistry of precursor soot will be discussed and a credible explanation for existence in the high temperature environment of a flame will be given for the first time.
(11) Experimental evidence will be presented that show fullerenes are produced in the particle phase in the flame during the carbonization process.
(12) Experimental evidence will be presented that show formation mechanism of the fullerenes in the particle phase.
(13) Experimental evidence from the literature will be presented to show that large amounts of the precursor soot material can be produced.
(14) A proposal for large-scale synthesis of fullerenes and nanotube in the condensed phase will be presented.

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