THE PHOTO-INDUCED IGNITION OF QUIESCENT ETHYLENE/AIR MIXTURES CONTAINING SUSPENDED CARBON NANOTUBES

by

Andrew Berkowitz

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Matthew A. Oehlschlaeger, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

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ABSTRACT

It has been previously shown [1] that single-wall carbon nanotubes (SWCNTs) with metal impurities ignite in air when exposed to a camera flash. Here the photo-induced ignition of quiescent ethylene/air mixtures containing suspended SWCNTs is demonstrated, to the author's knowledge, for the first time. SWCNTs with 70% by weight Fe impurity were injected into quiescent Φ = 0.5-1.5 ethylene/air mixtures at initial pressures of 1 and 2 bar in a static combustion chamber resulting in a suspension of SWCNTs which when exposed to a Xe camera flash provided distributed quasi-homogenous ignition of the fuel/air mixtures. High-speed camera images and pressure measurements were obtained for both SWCNT photo-ignition and traditional automotive spark ignition. Comparison of these two ignition processes illustrates a quasi-homogenous ignition with no discernable flame propagation for the SWCNT photo-ignition versus the point ignition followed by flame propagation that occurs in the case of spark ignition. The differences in the ignition phenomena for these two processes results in ignition delay and rise times for SWCNT photo-ignition that are around a factor of 1.5-2 shorter than those for spark ignition.