FUEL ADDITIVE EFFECTS ON SOOT ACROSS A SUITE OF LABORATORY DEVICES, PART 2: NITROALKANES

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This is the second in a series of papers to summarize results of the impact of nonmetallic fuel additives on soot. The research was conducted by a university, industry, and government team with the primary objective of obtaining fundamental understanding of the mechanisms through which additive compounds blended into a fuel affect soot emissions. The work involved coordinated testing across a suite of laboratory devices: a shock tube, a well-stirred reactor, a premixed flat flame, an opposed-jet diffusion flame, and a high-pressure turbulent reactor. This article summarizes results on the addition of nitroalkanes to a base fuel consisting of n-heptane and toluene as a simple surrogate for jet fuels. In these experiments, the nitroalkanes serve as chemical probes of key reactions leading to soot. The effects of nitroalkane addition on soot were found to be device and condition dependent with no simple trends across the suite of devices.

Keywords: Nitroethane; Nitromethane; Nitropropane; Soot

INTRODUCTION

The results reported in this paper were produced during a joint program with work at Department of Defense laboratories, universities, and an industrial laboratory. The overall technical objectives of this program were to (a) develop a fundamental understanding of the complex interactions of fuel additives with the processes that lead to particulate matter (PM) emissions from military gas turbine