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Diode Laser Measurements of HF concentrations from Heptane/Air Pan Fires Extinguished by FE-36 and FE-36 plus Ammonium Polyphosphate

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The mandatory phasing out of Halons 1301 (CF_3Br) and 1211 (CF_2ClBr) for use as the primary fire extinguishing agent aboard U.S. Army combat vehicles has led to the development of replacement agents such as FE-36 ($C_3F_6H_2$) and FM-200 (C_3F_7H). These chemicals though effective at extinguishing fires, typically require higher levels to achieve extinguishing concentrations. For example, a fire extinguished by Halon 1301 typically requires 66 percent more FM-200 to achieve the same extinguishing effect. With increased amounts of agent there is a concern with the levels of hydrogen fluoride formed as the primary decomposition product. That is, when fires occur in non-traditional environments and are extinguished by Halon 1301, FE-36, or FM-200, hydrofluoric acid (HF) is the primary toxic gas produced [1]. This concern has resulted in the replacement agents not yet being recommended for full use.

The two mechanisms by which HF concentrations can be decreased in real fire situations extinguished by FE-36, or FM-200 are: 1) Reduce the time required to extinguish the fire; 2) Release a scavenging agent in conjunction with the fire suppressant chemical to remove HF from the situation. The latter mechanism is investigated here with tunable diode laser absorption spectroscopy measurements of HF concentrations produced during an enclosed heptane/air pan fire extinguished by FE-36 and FE-36 plus ammonium polyphosphate (APP). APP is a commercially available chemical with fire retardant properties where the agent is typically suspended in an extinguisher as a gel and is released as a white powder. A series of extinguishment tests were conducted with various combinations of FE-36 and FE-36 plus APP. By measuring how much the HF concentrations are reduced with respect to a fire extinguished by FE-36 alone, the effectiveness of APP as a HF scavenging agent in a controlled fire situation will be demonstrated.

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Biography:
Dr. R. Reed Skaggs received his Ph.D. in Physical Chemistry in 1997 from The George Washington University. He is currently a American Society for Engineering Education (ASEE) Postdoctoral Fellow at ARL .

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