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Energetic-Nanoparticle-Enhanced Combustion of Liquid Fuels in a Rapid Compression Machine

An aerosol rapid compression machine is developed to investigate energetic-nanoparticle-enhanced combustion of liquid fuels using ethanol and aluminum nanoparticles as a model system. An ultrasonic nozzle is used to nebulize neat ethanol and mixtures containing nanoparticles for ignition delay tests in the rapid compression machine. It is determined that 2%-weight nano-aluminum can lead to a dramatic reduction in the ignition delay (90%). The aerosol is introduced to the rapid compression machine through a poppet valve that is optimized by CFD simulations to maximize turbulent mixing and improve charge homogeneity.

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