Enhancing the Combustion of Ammonia as an Alternative Fuel by Adding Ozone

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Nowadays, fossil fuel remains the main source of energy, which yields high CO2 emissions thereby contributing to global warming. Recently, ammonia fuel has shown potential as an alternative fuel in terms of price, versatility and CO2 free emission. However, ammonia has low flame speed, which causes low laminar burning velocity that has a significant role in predicting engine performance and understanding combustion mechanisms. Studies show that premixing ozone gas with fuels helped enhance the combustion process and flame stability. Therefore, the purpose of this project is to add ozone with ammonia for the first time in order to optimize the laminar burning velocity. The laminar burning velocity of the ammonia/ozone premixed flames were experimentally investigated at fixed temperature (300K), pressure (1 bar) and equivalence ratio (F = 1). However, different ozone concentrations including: 0, 1000, 2000, 3000, 4000, and 5000 ppm were tested. Spherically propagating premixed flames, which will proliferate in a constant volume combustion chamber, will observed using high-speed Schlieren photography. The maximum laminar burning velocity varied from (SLo=13.2 cm/s) in ammonia-ozone mixtures at 5000 ppm of ozone in contrast to ammonia-air (SLo = 7cm/s) that shows 88.57% increase as a result of the ozone addition. In conclusion, I expect that ozone addition will enhance the laminar burning velocity and it will help the movement of using ammonia as a CO2 fuel as well as in different engines types.

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