

Developing novel PIMS apparatus to study oxidation kinetics at engine-relevant pressures

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Recent progress in development of new types of internal combustion engines and biofuels revived interest in studying reaction kinetics responsible for low temperature oxidation. Since many of the reactions in question showed significant pressure dependence and occurred at high pressures (>10 atm), it was necessary to develop a novel experimental technique to study kinetics at high pressure. This work presents recent development of a high pressure photoionization mass spectrometer (PIMS) apparatus.

The apparatus was completed and tested in 2016. The key features are high-pressure flow photolysis reactor capable of operation at <100 atm and <700 K simultaneously and enhanced detection efficiency to counter the reduction of sensitivity due to dilution of reaction media by buffer gas. The test results indicate that it can probe oxidation kinetics at the engine-relevant conditions in great detail.