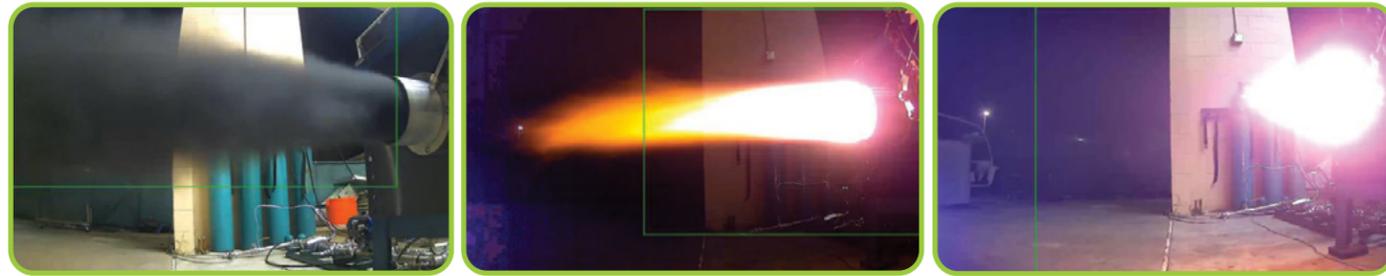


ADVANCES AND DISCOVERIES MADE IN COAL-FIRED ROTATING DETONATION ENGINE OPERATION AND BEHAVIOR

Coal-fueled rotating detonation engines are an emerging technology for efficient and clean power generation through pressure gain combustion.

SUCCESSFUL OPERATION OF ROTATING DETONATION ENGINE (RDE) USING PRIMARILY SUB-BITUMINOUS COAL

The University of Central Florida successfully increased the use of 5 μm ground sub-bituminous coal to fuel their RDE, a pressure gain combustion system. Previously, the system had primarily used carbon black as a fuel. Compared to carbon black with size of 29 nm and low volatility of 1.18%, the larger coal particles with higher volatility of 34 to 44% represented a significantly more challenging operating scenario.



Coal RDE test fires: non-reacting (left), deflagration (center), detonation (right)
University of Central Florida

EVIDENCE FOUND PROVING SOLID CARBON IS DRIVING DETONATION WITHIN THE COAL RDE

Presence of carbon required for detonation

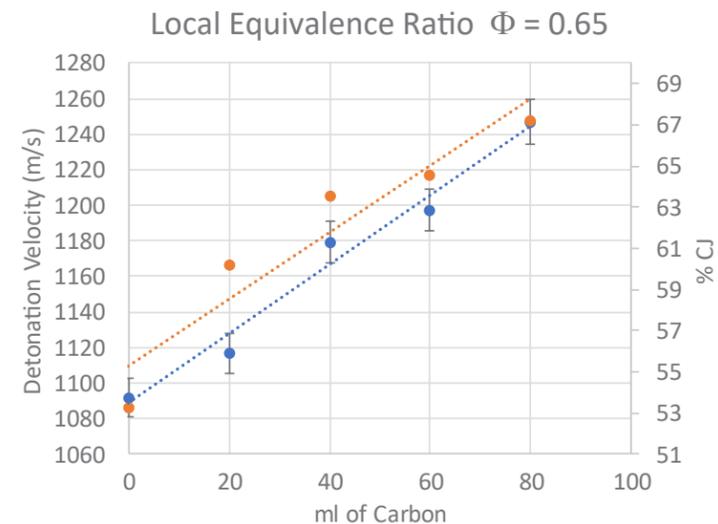
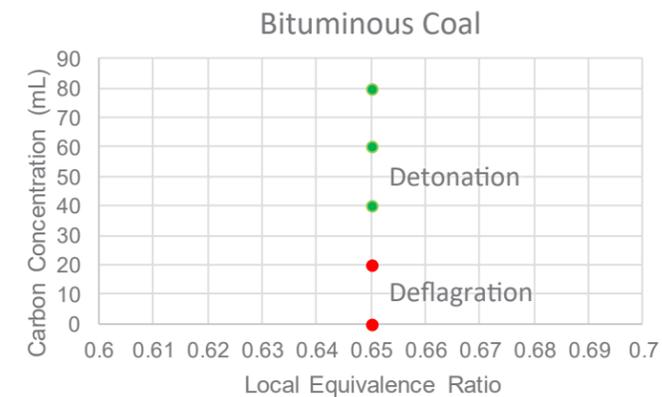
Maintaining a constant equivalence ratio of hydrogen during engine firing, with and without carbon present, showed that detonation only occurred when carbon was present in the fuel mixture at certain equivalence ratios.



Imaging of detonation wave dynamics visualized by high speed imaging with carbon present,
University of Central Florida

CARBON CONCENTRATION CORRELATES TO DETONATION WAVE SPEED

Gradually increasing the carbon concentration while maintaining a constant equivalence ratio of hydrogen demonstrated that increasing the carbon concentration led to an increase in the detonation wave speed. (If the carbon was experiencing afterburn rather than detonation, the wave speed would decrease as the carbon concentration increased.)



Experimental data (blue points) showing that as carbon concentration increases (horizontal axis) the detonation velocity (left vertical axis) also increases,
University of Central Florida

AWARD NUMBER
DE-FE0031545

PROJECT BUDGET



- DOE \$999,915
- PERFORMER \$290,973

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CORE COMPETENCIES

- ENERGY CONVERSION ENGINEERING
- PROGRAM EXECUTION and INTEGRATION

PARTNERS

