

Title: Investigation of low load performance and emissions of methanol engines using glow plugs.

In the search for cleaner and more efficient engines, this study explores the possibility of using glow plugs (like tiny heaters) in engines running on a sustainable fuel like methanol at low loads.

This study examined the effects of glow plugs in methanol engines, specifically focusing on four key aspects.

Combustion Dynamics: The influence of the glow plug on when combustion starts and how quickly it is completed, known as combustion phasing, was studied. Additionally, how consistently and predictably the combustion occurs and generates the required power was also examined, termed combustion stability.

Engine Efficiency: The research tried to determine whether adding a glow plug improved the engine's performance. It studied the ability to turn the fuel's energy into useful work (gross indicated efficiency) that can be used to move the vehicle with and without the glow plug. Additionally, it analysed combustion loss, representing the energy lost due to inefficient fuel combustion and heat transfer loss, accounting for the energy dispersed to the cylinder walls.

Emissions Analysis: The study analysed the engine's emissions, including pollutants like nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (HC), soot, and formaldehyde, with and without glow plugs.

Injection Strategies: The study also delved into different injection strategies to deliver fuel into the combustion chamber. It studied how the glow plug affects combustion stability, efficiency, and emissions in each strategy.

The study found that using glow plugs in different injection strategies had mixed results:

Single and Pilot Injection: Glow plugs didn't make much of a difference in these strategies. However, pilot injection seemed to match the efficiency and emissions of single injection at lower temperatures, which could save energy.

Homogeneous Charge Compression Ignition (HCCI): Using glow plugs made combustion happen earlier and made the engine more efficient. But it also led to more harmful emissions like hydrocarbons (HC), carbon monoxide (CO), and formaldehyde (HCHO), making this strategy less practical.

Partially Premixed Combustion (PPC): Glow plugs in PPC made ignition happen sooner and reduced emissions, but they caused some inconsistency in combustion. However, better placement of the glow plug and injection timing could further improve emissions and efficiency.

Overall, the study investigates glow plug use with different injection strategies for better engine performance and provides valuable insights. Future research can explore more PPC strategies by changing injection parameters and understanding how glow plug temperature affects engine ignition.