

https://dspace.org/

Analysis of injection spray patterns for common rail system

Alimia, Omid Iskander

2011-11-02
http://hdl.handle.net/10539/10687

Downloaded from a DSpace repository. https://dspace.org/

ABSTRACT

The objective of this study was to investigate and compare the fuel spray characteristics of DME and diesel fuel being injected through a common-rail fuel injection system into a constant volume pressure vessel containing nitrogen gas. The fuel pressure and the chamber pressure were varied from 200-500bar and 1-10bar respectively, all at room temperature conditions. Images of the spray were captured at a rate of 7500fps utilizing a high speed camera, with a CMOS sensor, in conjunction with a schlieren optical system. The images were then analyzed to determine quantitative aspects of the spray such as spray penetration, cone angle and mean spray velocity and qualitative aspects like evaporation and flash boiling. The fuel line pressure was also recorded and analysed to determine the effect that injection had on the pressure in the line. For the same injection conditions it was found that the penetration of diesel was greater than that of DME and the cone angle of diesel was greater than that of DME except at atmospheric back pressure. The pressure oscillation in the DME fuel line was smaller in amplitude and longer in duration than that of diesel. The DME spray exhibited signs of flash boiling and evaporation when injected into an environment at atmospheric pressure and room temperature. As the chamber pressure was increased the DME spray shape became increasingly similar to that of the diesel spray shape. The spray boundaries, however, differed with DME exhibiting a more defined fuel-to-air barrier and diesel exhibiting a fine mist at its boundary. The predicted spray penetrations of DME, using existing correlations, were accurate for atmospheric back pressure conditions only.