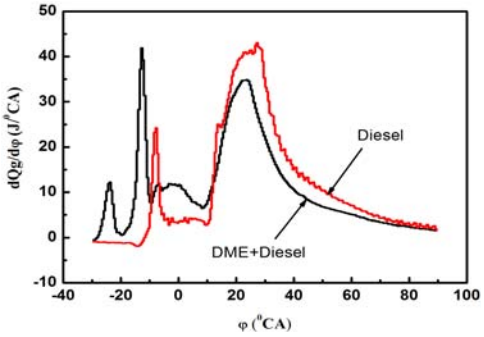

Fig. 5 Heat release rate versus crank angle

B. *Emission Characteristics*

Figure 6 is about the NOx Emissions under different loads. Under various conditions, the composite combustion has lower NOx emissions than the pure diesel combustion. It is mainly due to the higher latent heat of DME vaporization in the composite combustion mode, which reduces the cylinder temperature at the early combustion stage. And owing to the lower calorific value of DME combustion, the cylinder temperature of DME combustion is lower than that of pure diesel combustion. When the DME air premixed volume maintaining at 1.89kg / h, as the load increases, the NOx emission is largely reduced. This may be because the exhaust gas recirculation under a large load has large impact on on the homogeneous DME charge compression combustion.

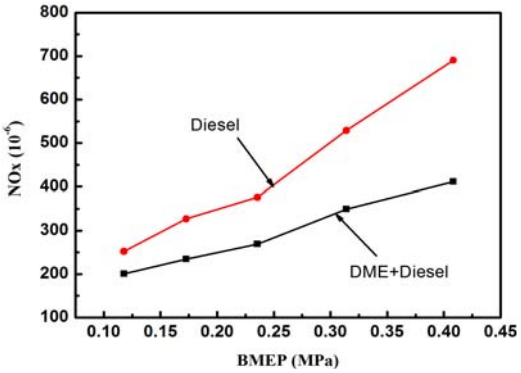

Fig. 6 NOx versus engine load

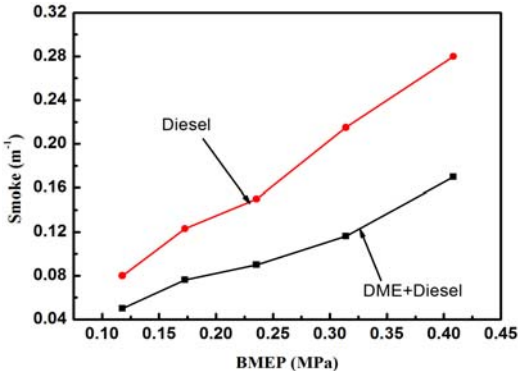

Fig. 7 Sote versus engine load

Figure 7 is the smoke emission curves with load variation in the two combustion modes. The figure shows that the emissions in the composite combustion mode are only about 50% of the emissions in the diesel DI mode. It is because DME, lacking C-C bond in its molecular structure, breaks down easily for oxidation reaction of combustion. As a result it is not easy to form carbon smoke nuclei. And it is easy for DME, with higher oxygen content, to complete oxidation of C. Under heavy load conditions, the DME HCCI facilitates the diffusion and combustion of diesel. In this way the smoke emissions in composite combustion mode are much lower than that in the diesel DI mode.

V. CONCLUSION

(1) The composite combustion mode of DME HCCI and diesel DI has a higher maximum peak pressure and a lower maximum combustion temperature than the pure diesel combustion mode. The composite combustion mode of DME HCCI and diesel DI is characterized by a 3-stage heat release process. The first stage involves the homogeneous compression combustion of DME and air. The second stage involves besides the homogeneous compression combustion of DME and air also the pre-mixed combustion of pilot diesel injection. The third stage involves the pre-mixed and diffusion combustion of diesel injection.

(2) The composite combustion mode of DME HCCI and diesel DI, when the premixed DME intake being maintained at a certain amount, can effectively reduce NOx and smoke emissions.

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