

AMMONIA FUEL ENGINES: THE CHANGE OF TRIBOLOGICAL BEHAVIOR FOR THE CYLINDER LINER - PISTON RING

Zetong Wang^a, Xuan MA^a, Xing XU^{a*}, Xiqun LU^a

*corresponding.author xu-xing@hrbeu.edu.cn

^a Affiliation1,

Harbin Engineering University, China

KEYWORDS

Friction; wear; lubricant additives, corrosion

ABSTRACT

As a hydrogen-rich carbon-free fuel, ammonia fuel has attracted great attention on the engine field recently. However, there are few references available for investigating the tribological behaviors of the ammonia-fueled engine, which limits the development of the ammonia-fueled engine. For this purpose, the cylinder liner-piston ring (CLPR) was chosen as the research object for it is one of the most important friction pairs in the engine. And a systematic research strategy for the study of the tribological behaviors of CLPR in the ammonia-fueled engine is conducted, as shown in Fig. 1. Based on the combustion performances of ammonia fuel, the inherent structural characteristics of the engine and the multi-lubrication state of the CLPR, the action mechanism of ammonia on the tribological behaviors of the CLPR can be explored from three levels.

(1) The first is Extreme Boundary 1. Three typical working conditions are established, such as in the dry friction, the water medium and the ammonia solution medium. The effects of ammonia and ammonia solution on the tribological behavior and the surface damage of CLPR are clarified through a comparative study.

(2) The second is the Extreme Boundary 2. The effects of the water and the ammonia solution on the lubricating oil are considered. The action mechanism of the ammonia and the ammonia solution on the physico-chemical performances and lubrication properties of the lubricating oil is analyzed.

(3) The last one involves Multiple Conditions. Based on the results of Extreme Boundary 1 and Extreme Boundary 2, the dynamic influence mechanism between the water, the ammonia fuel and the lubricating oil are analyzed. And the multi-factor coupling research for the tribology (Friction, Wear and Lubrication) of the CLPR is carried out, accordingly.

The above research strategy can systematically study the tribological behaviors of CLPR in the ammonia-fueled engine under different working conditions. And the results of Extreme Boundary 1 and Extreme Boundary 2 can guide and explain the

research of Multiple Condition. Meanwhile, the complex tribological behaviors of the CLPR in the ammonia-fueled engine can be decoupled by this method. Overall, this study serves as a foundational contribution to the field of tribology in ammonia fuel engines.

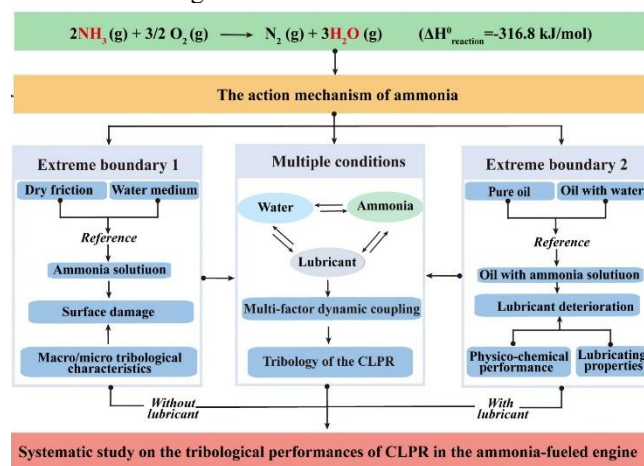


Fig.1 A systematic research strategy for the study of the tribological behaviors of CLPR in the ammonia-fueled engine

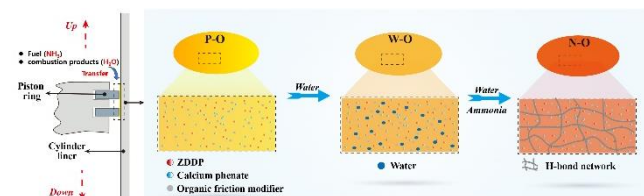


Fig.2 The influence mechanism of different components on lubricating oil in ammonia fuel engine

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