

## ANALYSIS OF SEIZURE INTERFACE BETWEEN STEEL CRANK JOURNAL AND ALUMINUM ALLOY PLAIN BEARING

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### KEYWORDS

*Friction; Wear; Experiments in tribology, Plain bearing*

### ABSTRACT

Achieving carbon neutrality requires significant reduction in friction, essential for reducing energy loss in automobiles. Among components where friction occurs, achieving ultimate friction reduction between the crankshaft and plain bearings of passenger car engines is critical. This is because such advancements can be directly applied in engines utilizing alternative fuels like hydrogen, which have been under development in recent years. Therefore, there is a pressing need to develop friction reduction methods further to enhance fuel efficiency. On the other hand, downsizing and turbocharging aimed at improving fuel efficiency have toughened the sliding conditions of bearings, further promoting engine downsizing with the introduction of Hybrid Electric Vehicles (HEVs). A major problem here is the "seizure" occurring between the crankshaft and plain bearings, which limits driving conditions. While there is a wide range of conventional research on seizure, there is a lack of instances investigating the phenomenon using actual engine plain bearings. Therefore, the authors conducted seizure tests using the engine bearing test rig shown in Fig. 1, evaluating the seizure characteristics between a steel crank journal and an aluminum (Al-Sn-Si) alloy plain bearing. Additionally, through detailed analysis of the measured AE (Acoustic Emission) and observation and analysis of the surface, it has been confirmed that the occurrence of adhesive wear significantly affected to seizure<sup>[1]</sup>.

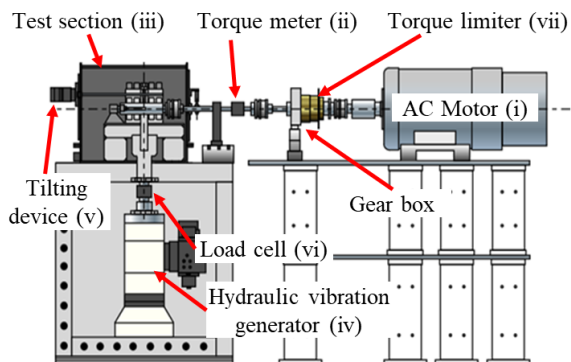


Fig.1 Engine bearing test rig

In this study, in order to identify the main cause of adhesive wear between the steel journal and the aluminum alloy sliding bearing, SEM observation and EDX analysis of the adhered interface were conducted

(Fig.2). Fig.2(a) shows a cross-section observed at 800 times magnification of the area where the adhesion was confirmed on the surface of the steel journal, while (b) and (c) respectively show the mapping results by EDX of aluminum and iron. It was revealed that aluminum from the bearing alloy(b) adhered to the steel journal(c), indicating that the adhesion between aluminum in the bearing alloy and the steel journal is the main cause of seizure. Figure 2(d) shows the interface between the steel journal and the adhered aluminum observed at 50,000 times magnification. Surprisingly, no intermetallic compounds were detected, confirming that aluminum adheres closely to the surface of the steel journal. From these results, it is inferred that the seizure is in a firmly bonded state similar to friction welding.

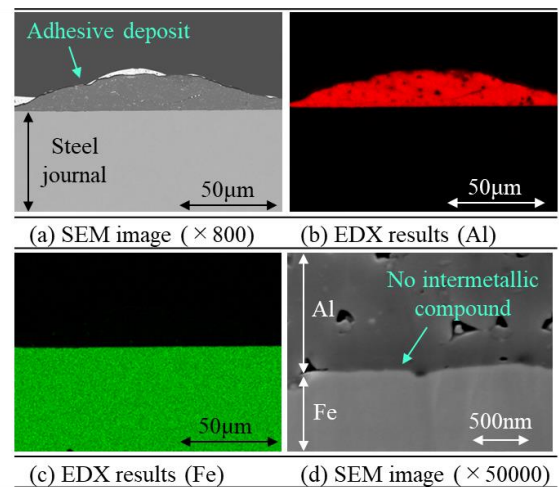


Fig.2 SEM/EDX analysis results of journal cross-sectional section

### ACKNOWLEDGEMENTS

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### REFERENCES

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