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An Investigation on Oil Consumption in 4-Cycle Engine (Third Report)

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In the first report[(1)], the relationship between engine oil (EO) consumption and NOACK, the single grade engine (SGE) oil consumes more oil (OC) than the multi-grade engine (MGE) oil, and the second report[(2)], we constructed and proposed an EO consumption model and reported that EO design effects on EO consumption. In this report, while considering the effect of the base materials on OC, based on the analysis of the test data so far, the effect of the friction modifier on OC and the oil mist that could not be reported in the first and second reports. We investigated the effect of chemical conversion on OC and the energy force of the van der Waals force acting between the base oil and the polymer base materials. In addition, the 4-cycle EO consumption optimization model (hypothesis) proposed in the second report has specific conditions (necessary) for oil design obtained from gasoline engine (GE) test and diesel engine (DE) test data analysis. Required number(Key Value) was added, and we tried to list the EO consumption optimization model for oil design, so we will also report it. Please refer to the first report for evaluation matrix, oil properties, test methods, etc. All subsequent OC data are the normalized data reported in the first report.

Example result are shown Figure 1, 2 and 3.
In figure 1, shows the results of an evaluation of oil consumption in a gasoline engine test using OCP and star type (HSD) VII, which are typical examples of non-polar VII. The molecular weights of OCP A and OCP B are about the same, but from different suppliers. From this result, it was confirmed that there was a difference in oil consumption even with the same type of VII. Also, in this figure, OCP tended to consume less oil than HSD among non-polar VIIs. This suggests that even non-polar polymer base materials have different OCs if the chemical type and structure of the base materials are different. So far, we have investigated the effects on OC mainly of base oils and polymers (VII and PPD), but we also examined the effects when friction modifiers are used. Figure 2 and 3 show the data with and without the use of friction modifier. From the figures, a simple comparison shows that oil consumption is improved by more than 10% with and without the friction modifier.

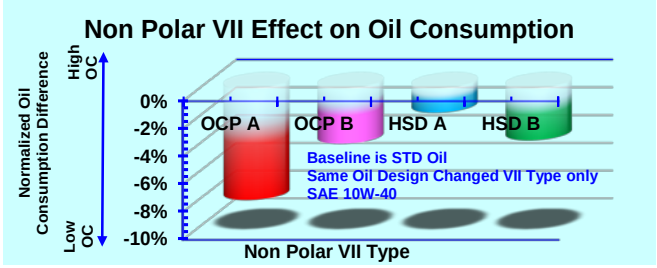

Figure 1 Comparison of Non-Polar Viscosity Index Improver

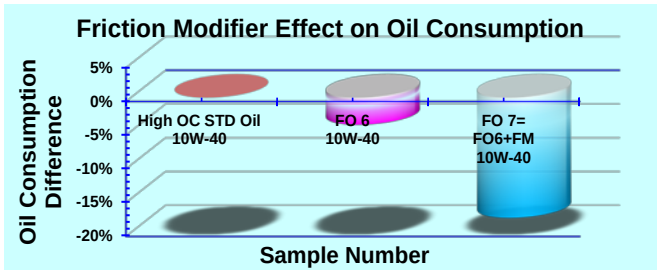

Figure 2 Relationship Among Oil Consumption, NOACK and Friction Modifier

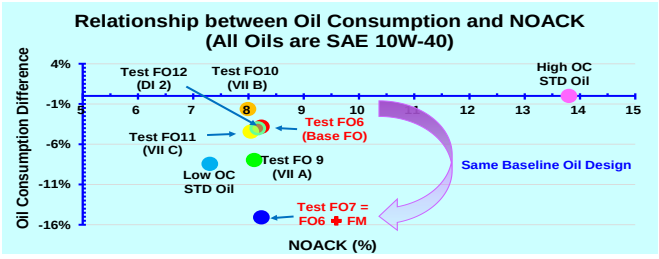

Figure 3 Relationship Among Oil Consumption, NOACK and Friction Modifier

Reference

(1) H.Watanabe, B. H. Kang, "An Investigation on Oil Consumption in 4-Cycle Engine (1st Report)" JSAE 2021Annual Congress(Spring) Proceedings Paper Number 20215230
(2) H.Watanabe, B. H. Kang, "An Investigation on Oil Consumption in 4-Cycle Engine (2nd Report)" JSAE 2021Annual Congress(Autumn) Proceedings Paper Number 20216173