SHIMADZU APPLICATION NEWS

LAAN-A-TA-E004

● THERMAL ANALYSIS

No. T139

Measurement of Engine Oil by DSC-60 + TAC-60L

Engine oil serves as not only a lubricant, but also it works in a variety of ways – as a sealant, a coolant, an anti-corrosion agent, a cleanser – to protect the engine. Viscosity is known as one of the classification method of engine oil. Viscous oil is separated into categories defined by the Society of Automotive Engineers (SAE) and these categories are determined based on the external air temperatures in which a specific oil can be used.
In this analysis, we applied DSC-60 and TAC-60L to 3 types of oils with varying degrees of viscosity to measure oil freezing, fusion, and the differences between new and old oils. TAC-60L is a cooling option that automatically feeds liquid nitrogen. This allows us to maintain a steady of consistent flow of liquid nitrogen during the analysis.
A smooth, non-pulsating supply of liquid nitrogen allows us to achieve a stable baseline that is equivalent to the measurement without cooling.

Fig.1 DSC-60 + TAC-60L

■ Measurement of Engine Oil A

After cooling the engine oil to -120 ˚C below room temperature to freeze it, the oil was then heated back to room temperature until it was in a liquid state.
This engine oil began to freeze at approximately -20 ˚C and was completely frozen at approximately -98 ˚C. During the heating process, we saw that the oil began to fuse over a wide range between -91 ˚C and -10 ˚C.

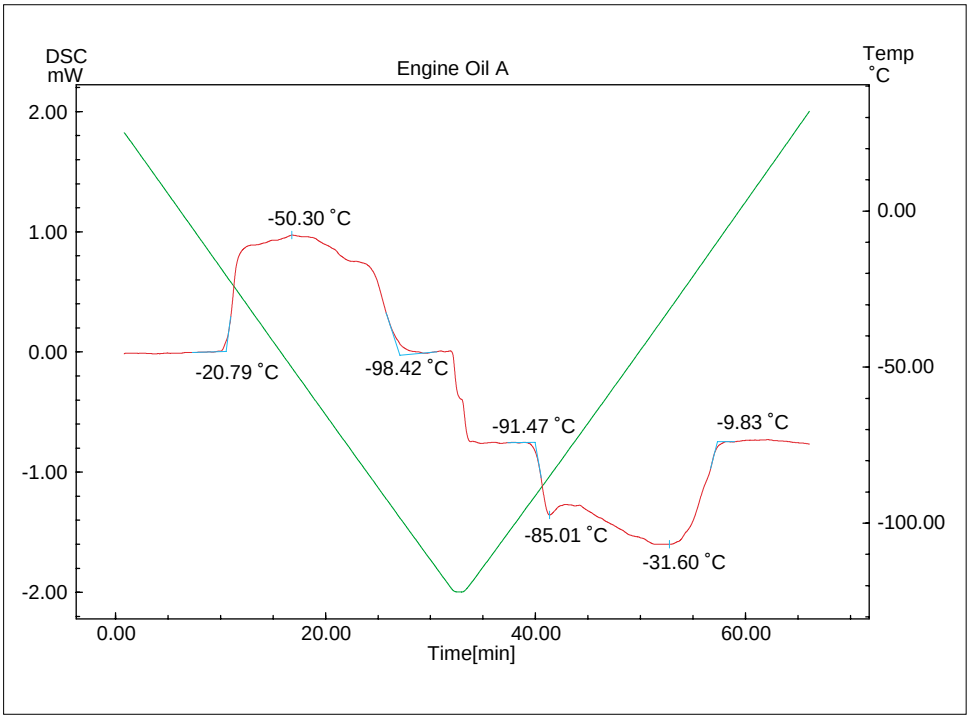

Fig.2 DSC Curve of Engine Oil A

Table 1 Analytical Conditions

Sample volume	: 24.48 mg
Cell	: Aluminum
Atmosphere	: Nitrogen
Flow	: 50 mL/min
Temperature rate	: 5 ˚C/min
Temperature range	: -120 ˚C to 30 ˚C

■ Measurement of Various Engine Oils

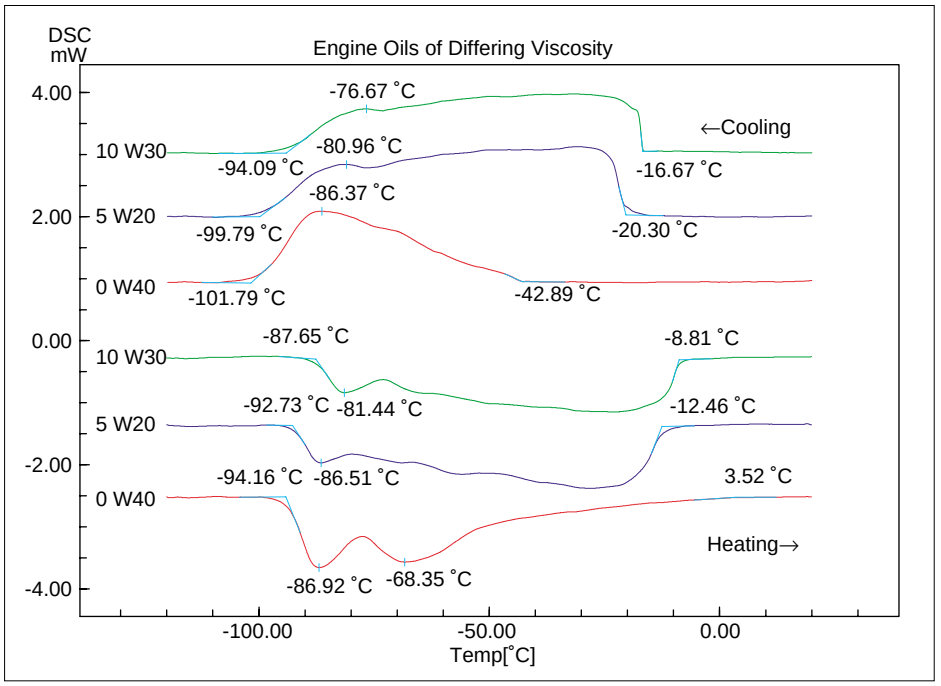

Fig.3 DSC Curves of Various Engine Oils

Oils of 3 different categories were cooled from room temperature to -120 ˚C and then heated back to room temperature. These oils all had different degrees of viscosity.
With 0 W-40, 5 W-20, and 10 W-30, the lower the number preceding the W, the lower the level of viscosity. Comparing actual data shows that while 10 W oil begins to freeze at -16.7 ˚C, 0 W oil finally begins to freeze at -42.9 ˚C, which shows that oils with a lower viscosity have a lower freezing point and that, of the 3 types of oils, 0 W-40 is best suited for cold-temperature regions.

■ Measurement of New and Old Engine Oils

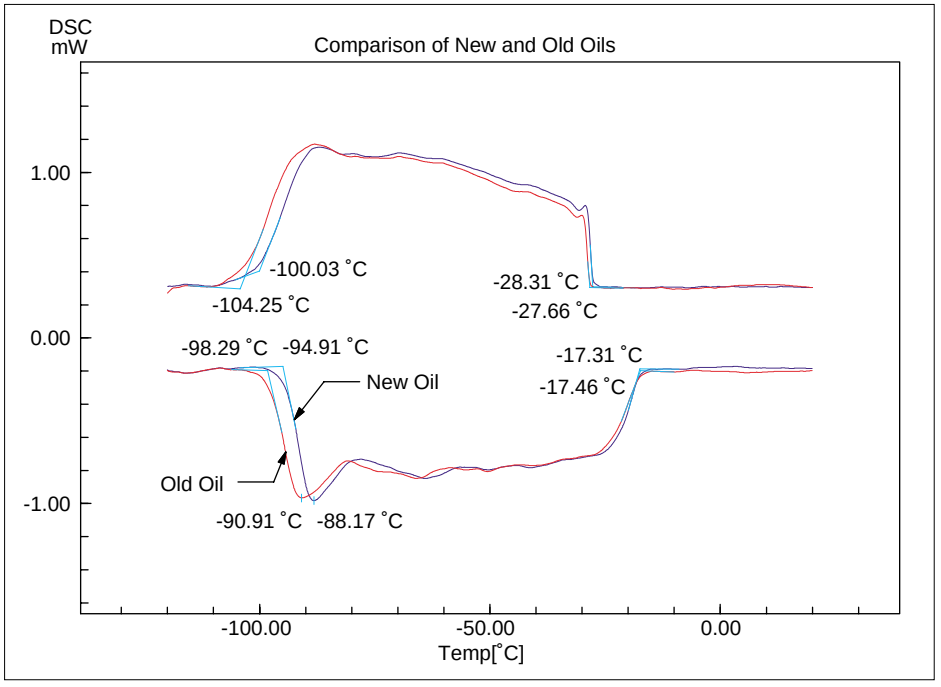

Fig.4 DSC Curve of New and Old Engine Oils

We analyze the same type of oil for pre- and post-use differences. There was no difference in the freezing initiation points of new and old oils but we did see differences in the freezing completion temperatures and allowance fusion points. We assume these differences to be due to oil degradation.

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