

THERMAL-PETRO

Author**Dr. Yogesh Satpute**

Application Specialist – Materials Characterization
and Lab In-charge
Customer Knowledge Centre for Analytical Sciences
PerkinElmer (India) Pvt. Ltd.
Thane – 400 615 India.
Email: application.india@perkinelmer.com

Estimation of soot content in engine oil using Thermo Gravimetric Analysis (TGA) as per ASTM D5967 Method

Abstract

Internal combustion in engines produces soot as a result of incomplete fuel combustion. High level of soot content in oil leads to a higher lubricant viscosity impeding oil flow and to carbon deposition in the piston ring. It will also affect anti-wear lubricant additives resulting in increased engine wear and premature engine failures. As a result, soot content monitoring is an important parameter for engine oil. There are other methods available for the determination of soot content however the present note describes soot content determination using TGA as per ASTM D5967 method.

Sample analysis

Around 9 mg of sample is weighed in a TGA balance and heated up to 650 °C in nitrogen environment, to remove all the volatiles and other organic materials as per the method described in instrumental conditions. The environment is then changed to oxygen at 650 °C to burn off the soot. The soot content is determined by the difference observed in weight from oxygen switch over until stable weight residue or unchanged weight loss is observed for 5 min or longer.



Instrumental conditions

Instrument	Pyris 1 TGA
Temperature Program	1) Isothermal hold at 50 °C for 1 min 2) Heat to 550 °C at 100 °C/min 3) Isothermal at 550 °C for 1 min 4) Heat to 650 °C at 20 °C/min 5) Heat to 750 °C at 20 °C/min 6) Isothermal hold at 750 °C for 5min
Purge gas	Initial purge gas nitrogen 30ml/min Switch purge gas to oxygen at 650 °C (step 4)
Sample pan	Platinum crucible
Sample weight	9.2 mg

Analytical results

Soot content was determined for a used engine oil sample by ASTM D5967 method using TGA and the soot content was found to be 4.72%. A thermogram for this analysis is shown in Figure 1.

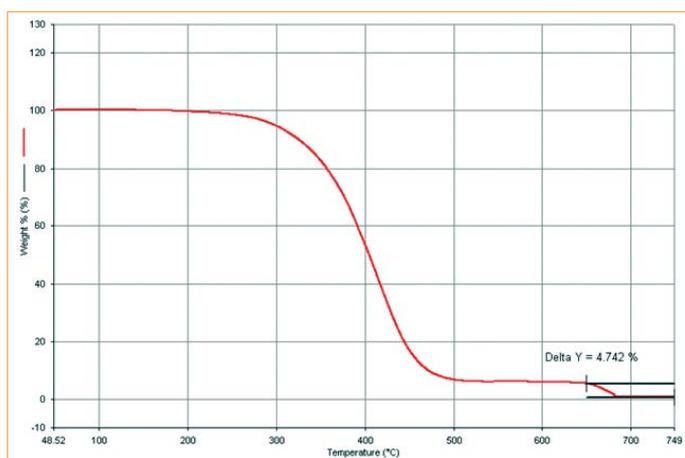


Figure 1: TGA thermogram showing % soot of used engine oil sample

Conclusion

Soot content determination is one of the important parameters monitored in engine oil because of the number of implications it has on engine performance. Pyris 1 TGA provides an easy, simple and an accurate way to measure the soot content by ASTM D5967 method. The method relies on measuring the difference in weight produced by combustion of soot to give % soot value.