

ASTM D971 standard test method for interfacial tension of oil against water by the ring method

This application note describes how the Attension Sigma 702ET can be used to measure interfacial tension of oil against water according to the ASTM D971 standard.

Description of the standard

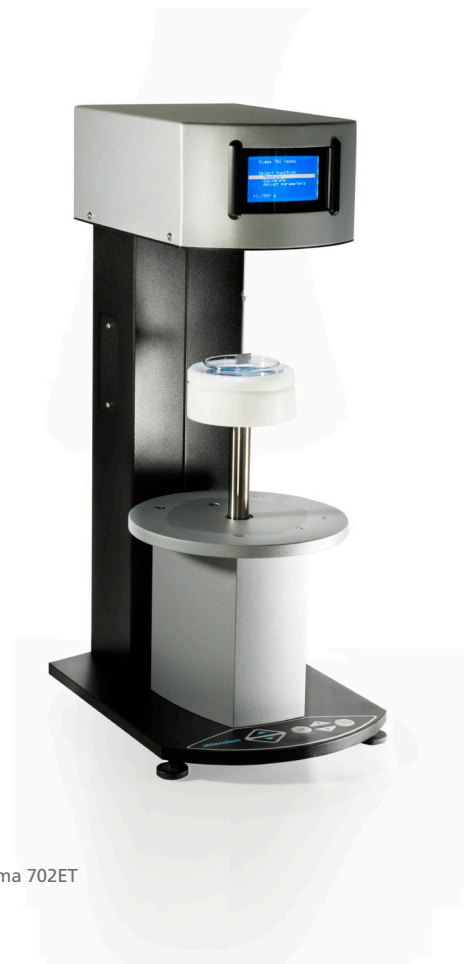
This application note describes the measurement of interfacial tension between oil and water under non-equilibrium conditions by using the ring method according to the ASTM standard. The Attension Sigma 702ET allows a precise characterization of water-oil interfacial tension with this standard. The method is especially important in petroleum industry as it can be used to determine oil purity.

In this interfacial tension measurement the platinum ring is lifted through the water-oil interface. The oil is lying on the water surface due to the density difference of these two liquids. Water has a higher surface tension than the oil and therefore force is needed to detach the ring from the water surface. The force measured is used to calculate the interfacial tension (mN/m) between oil and water. The measurement is made within 60 seconds after formation of the interface with a tensiometer determining tension between 0-100mN/m. The Sigma 702ET fulfills the requirements of the ASTM D971 standard. The instrument allows the measurement to be done fully automatically. A high interfacial tension value (40mN/m) [1] indicates the absence of undesirable polar contaminants in the hydrocarbon fluid which means that the fluid is immiscible with water. A decrease in interfacial tension occurs for example due to accumulation of contaminants or due to formation of oxidation by-products. The impurities in the hydrocarbon fluid encourage the oil to mix with water.

General applications

The ASTM D971 standard is used to determine the possible contaminants of hydrocarbon fluids. The purity of hydrocarbon fluids is important in many industrial areas, such as in aviation, diesel fuels and transformer oils. For example in aviation, jet fuel needs to be highly purified as water or dirt contaminations can

cause serious danger in flight safety. Surfactants in jet fuel can cause the lifting of rust in storage tanks as well as absorption of water on coalescing surfaces [2]. The ASTM D971 standard is also a useful indicator of the cetane number of diesel fuels [3]. The cetane number of diesel fuels is used to define the quality of combustion during ignition.



Attension Sigma 702ET

Transformer oil testing

An important use of the standard is the testing of insulating oils. Insulating oils are used in power transformers to provide cooling, insulation and protection against corona and arcing. Transformers are used especially by electrical industry to transfer electrical energy from one circuit to another. Transformer oils are exposed to mechanical and electrical stress as well as to chemical contaminations during the operation of the transformer. These lead the original properties of the transformer oil to change within time, which can reduce the functionality of the oil. To maintain and extend the life of the power transformer, regular testing of the transformer oil is required. The ASTM D971 standard is used in the process of defining the general electrical and physical properties of transformer oil [4].

References:

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- [3] Surface Tension as an Indicator of Cetane number of Diesel Fuels, Omer L. Gülder, George Moroz, NCR div. of Mechanical Engineering, Society of Automotive Engineers (1986)
- [4] A Guide to Transformer Oil Analysis, I.A.R. Gray, Transformer Chemistry Services

