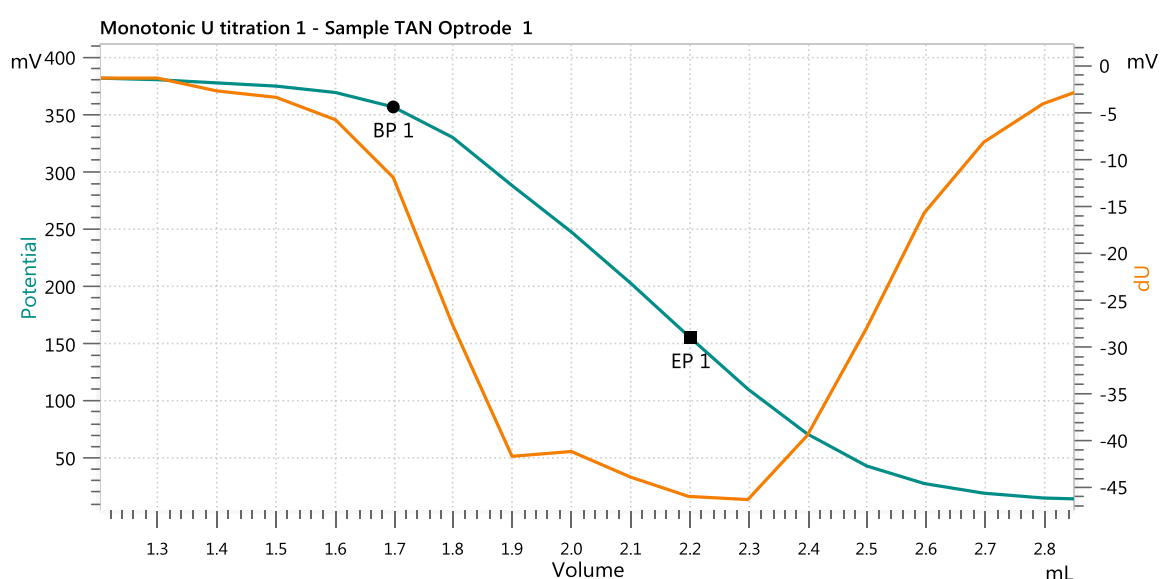


Titration Application Note T-092

Acid number in insulating, transformer and turbine oils

Use of a photometric sensor increases precision and reliability for the determination according to ASTM D974



The acid number (AN) of insulating, transformer, and turbine oils is crucial to ensure safe operation, operating equipment control, and corrosion prevention. These oils generally have low AN specifications and their AN determination by manual color-indicator titration is difficult, especially when analyzing colored samples.

Using a Titrator with a photometric sensor to detect the end point ensures that the titrations are always carried out under the same conditions. This greatly increases the precision and reliability of the results, which in turn results in improved monitoring for your operations.

Here, the fully automated photometric determination of the AN using the Optrode satisfying ASTM D974, ISO 6618, and IP 139 is described. The sample is titrated with alcoholic KOH solution to the p-naphtholbenzein green brown end point. A break point evaluation of the titration curve is used which corresponds with this endpoint.

Method description

Sample

Transformer oil
Insulating oil

A blank determination is carried out the same way as the sample determination, but omitting the sample and with a titration volume increment of 0.01 mL.

Sample preparation

For used oils containing sediments, see ASTM D974.

Configuration

OMNIS Sample Robot S Pick&Place	2.1010.1010
OMNIS Advanced Titrator without stirrer	2.1001.0210
OMNIS Dosing modules	2.1003.0010
OMNIS 50 mL cylinder unit	6.01503.250
OMNIS 10 mL cylinder unit	6.01503.210
OMNIS 2 mL cylinder unit	6.01503.120
Analogue measuring modules	6.02101.010
Rod Stirrer "Sample Robot"	2.1006.0010
Stirring propeller 20 mm EFTE	6.01900.030
Optrode	6.1115.000

Solutions

Titrant	c(KOH) = 0.01 mol/L in 2-propanol
Indicator	p-naphtholbenzein (Aldrich 291099)
Indicator solution	β (p-naphtholbenzein) = 10 g/L \pm 0.01 g/L in solvent 1.0 g naphtholbenzein is weighed into a 100 mL volumetric flask and filled up to the mark with solvent.
Solvent mixture	500 mL toluene, 495 mL isopropanol and 5 mL CO ₂ -free deionized water are mixed.

Parameters

Mode	MET U
λ	610 nm
Pause	0 s
Signal drift	30 mV/min
Min. waiting time	0 s
Max. waiting time	38 s
Volume increment	0.1 mL
Stirring rate	10
Stop volume	10 mL
Stop EP	1
Volume after EP	1 mL
EP criterion	30 mV
EP recognition	greatest
BP criterion	0.2
Min. deflection	0.9
Max. expected BPs	3
BP recognition	first

Results

Sample No.	TAN / mg KOH/g sample (n = 3)	s(rel) / %
1	0.005	0.00
2	0.047	0.12
3	0.550	1.18

Analysis

An appropriate amount of well-mixed sample is weighed into the titration vessel. 75 mL of solvent and 0.25 mL p-naphtholbenzein indicator solution are added. The solution is stirred for 30 s in order to dissolve the sample and titrated with c(KOH in IPA) = 0.01 mol/L until after the break point using the Optrode at 610 nm. After each titration, the buret tips as well as the sensor are cleaned using a dip-rinse in solvent for 30 s.