

دستگاه اندازه‌گیری کشش بین‌سطحی به روش قطره‌آویزان در دما و فشار بالا  
HP-HT Pendant Drop Interfacial Tension Measurement Apparatus  
(IFT-PDSA-06)



Apex technologies co., designed and manufactured a new generation, compact and easily portable high pressure high temperature pendant drop interfacial tension equipment rated for maximum pressure and temperature of 10000 psi and 150 °C basically made of stainless steel 316 L. This equipment is one of the most applicable equipments in different areas to measure the IFT of HP-HT liquid-liquid and gas-liquid systems and even to investigate the asphaltene onset pressure and minimum miscibility pressure (MMP). The equipment is comprises of an annulus type main chamber has four ports two of them for needle positioning and two of them for bulk and drop injection into the main chamber. The annulus chamber is designed in way that



it is possible to position both of the upward and downward drop injection needles concomitantly make the drop injection for various fluid so easy. In addition, a temperature controllable accumulator consisted of two separated piston floated chambers are used to inject the bulk and drop independently using two miniature manual hydraulic pump.

In addition, the system is equipped with a CCD camera and computer macro lens as all of the similar equipments manufactured by competitors have. The formed drop is analyzed by professional drop shape analysis software (Apex DSA software) work based on both pendant drop and sessile drop methods known as the most important drop shape analysis methods. In addition, the software is written in a way that it is possible to measure the contact angle using sessile and tangent methods. This section is written in way that it is possible to calculate the work of cohesion, work of adhesion and spreading coefficient which are so important parameter to investigate the wettability of interfaces.

#### *Technical Specifications:*

- ✓ Temperature controllable accumulator (Necessary for injection of live crude oil)
- ✓ **Excellent stability of drop due to innovative design of injection needles**
- ✓ Valves and connections: BuTech/Autocalve/Vinci type valves
- ✓ Macro lens: Computer (C mount, magnification of 10×)
- ✓ HP-HT cell equipped with two sapphire sight glasses
- ✓ Pressure transmitter accuracy: 0.2 % full scale
- ✓ IFT range of measurement: 0.7-72 dyn/cm
- ✓ Manual XYZ camera positioner × 1
- ✓ Max. working temperature: 100 °C
- ✓ Max. working pressure: 400 bar
- ✓ Temperature resolution: 0.1 °C
- ✓ Wetted material: S.S.316 L
- ✓ Basler CCD camera: 2 MP



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- ✓ Main cell volume: 20 cc
- ✓ Pressure transmitter × 1
- ✓ Cold back light×1
- ✓ Online professional special software including pendant drop method for measurement of IFT
  - Software exports excel file including the density of drop, density of bulk, drop volume, IFT, contact angle, bond number, small diameter, large diameter, ...
  - Adjustable time of analysis in three different levels to reduce the number of captured images based on the operator desires.
  - Online demonstration of measured properties in table as a function of time.
  - Recording captured images as a function of time in a folder
  - Online demonstration of properties variations.
- ✓ Automatic injection of bulk and drop phases using two HP single pumps × 2
  - Pressure transmitter accuracy: 0.2 % full scale
  - Displacing volume resolution:  $2 \times 10^{-5}$  cc
  - Max. working pressure: 400 bar
  - Min flow rate: 0.001 cc/min
  - Max. flow rate: 7 cc/min
  - Cylinder volume: 100 cc
  - Pressure transmitter × 1