Drop Shape Analyzer

DSA100HP

Drop Shape Analyzer – DSA100HP
(DSA100HP1750 configuration)

Wetting and surface tension under extreme pressures and temperatures

The Drop Shape Analyzer – DSA100HP is our high-quality solution for the precise measurement of contact angle as well as surface and interfacial tension under high pressures and temperatures, primarily for tertiary oil recovery. The DSA100HP combines the DSA100 setup for optical drop shape analysis with a measuring cell for high-pressure applications up to 1750 bar. It determines the surface tension and analyzes the wetting of oil-bearing rock by surfactant solutions under the extreme pressure and temperature conditions found in reservoirs. The results help in the extraction of oil from layers of rock in the most effective manner using enhanced oil recovery (EOR) methods such as steam or surfactant flooding and thereby increase the yield.

Tasks and applications

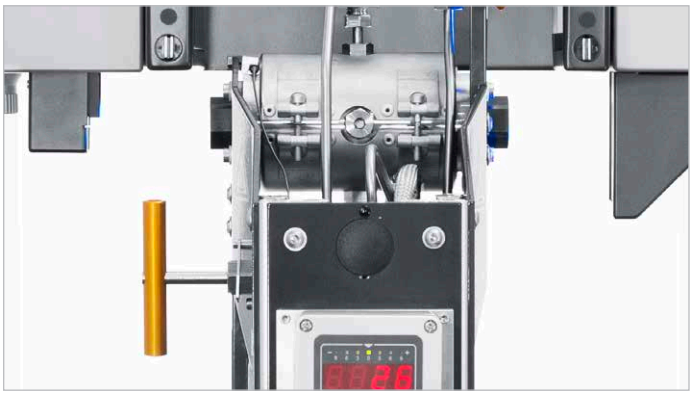
- Surface tension of flooding solutions and their interfacial tension with oil under reservoir conditions
- Wettability and extraction of oil from oil-bearing rock
- Pressure extraction by means of liquefied gases, e.g. carbon dioxide
- Development of surfactants for liquid gases

Measuring methods and options

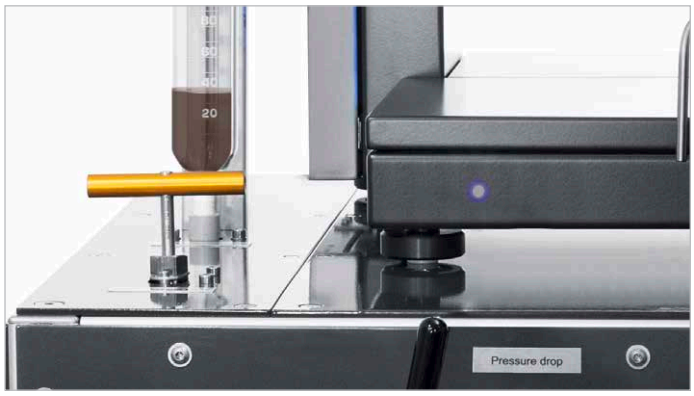
- Contact angle measurement using a sessile drop
- Surface tension of a liquid in gas or interfacial tension between two liquids using a pendant drop
- Upside-down pendant drop measurement of an oil drop in water
- Measurements at pressures up to 1750 bar and temperatures between -10 and 250 °C

Versatile options for dosing and measuring

With the aid of the dosing units of the DSA100HP, the drop liquid and the surrounding phase easily reach the inside of the high pressure cell. Rock samples can be positioned from the outside to measure the wettability at different positions while maintaining the pressure. The flexible design also allows contact angle measurements in a surrounding liquid phase. Precise temperature control up to 250 °C is achieved by means of an electric heater.



Sample positioning with closed pressure chamber.



Either a gas or a liquid can be added as surrounding phase.

Reliable drop shape analysis thanks to high imaging quality

The DSA100HP features a high-resolution camera and a quality zoom lens for accurate display of the drop with optimum size. The high image quality that this achieves leads to a precisely measured contact angle or surface/interfacial tension. Combined with the intelligent image evaluation algorithm of the ADVANCE software, drop shape analysis with the instrument provides exact results.

Specifications

Camera system	
Connection	USB 3.0
Performance	CF04: up to 2300 fps CF06: up to 3400 fps
Optics	
Zoom	7× zoom, manual
Pressure control	
Maximum pressure	40 to 1750 bar (580 to 25 000 psi)
Temperature control	
Range	up to 250 °C

Pressure chamber	
Material	stainless steel, Hastelloy©, or Inconel©
Contact angle	
Range	0 to 180°
Resolution	0.01°
Interfacial and surface tension	
Range	0.01 to 2000 mN/m
Resolution	0.01 mN/m

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Specifications

Product group specifications	DSA100HP40	DSA100HP690	DSA100HP1750
Camera system			
Connection		USB 3.0	
Resolution		CF04: 1920 x 1200 px CF06 [1]: 640 × 480 px	
Frame rate		CF04: 2300 fps CF06: 3400 fps	
Dark noise		CF04: 7 electrons CF06: 10.5 electrons	
Dynamic range		CF04: 73 dB CF06: 56.6 dB	
Optics			
Focus		manual	
Zoom		7× zoom, manual	
View angle		±4°	
Field of view		CF04: 3.9 mm × 3.9 mm to 24.7 mm × 24.7 mm CF06 [1]: 1.7 mm × 1.3 mm to 10.8 mm × 8.1 mm	
Resolution		CF04: 3.1 to 21.7 µm CF06 [1]: 2.5 to 17.8 µm	
Illumination			
Type		high power monochromatic LED	
Wave length, dominant		470 nm	
Field of light		46 mm × 46 mm (D × H)	
Dosing system			
Dosing		manual	
Drop deposition		manual	
Piston, volume	5 mL	5 mL	11 mL
Stages		x-axis [1]	
Control		manual	
Length		10 mm	
Software			
ADVANCE		contact angle interfacial and surface tension of liquids	

[1] optional

General specifications	DSA100HP40	DSA100HP690	DSA100HP1750
Sample dimensions			
Maximum sample space	40 cm^3	25 cm^3	25 cm^3
Maximum measuring surface		10 mm × 0 mm	
Pressure control			
Maximum pressure	40 bar (580 psi)	690 bar (10 000 psi)	1750 bar (25 000 psi)
Temperature control			
Type	fluid	electrical	electrical
Range	20 to 200 °C	20 to 200 °C	20 to 250 °C
Flow-through thermostat	yes	-	-
Temperature measurement			
Range	-50 to 400 °C		
Resolution	0.1 °C		
Precision	0.1 °C		
Accuracy	1/3 DIN B (±0.1 °C at 0 °C to ±0.8 °C at 400 °C)		
External sensor	2 connectors (PT100) [5]		
Locations	sample stage, chamber, cuvette		
Housing and peripherals			
Compartment	test liquids protected against light		
Needle protection shield	yes		
Camera und optics housing	yes		
Control keyboard	PC keyboard for ADVANCE software operation available (KB20)		
Levelling	yes		
Environment			
Operating temperature	10 to 40 °C		
Humidity	without condensation		
Instrument dimensions			
Footprint	900 mm × 600 mm (W × D)		
Height	900 mm		
Weight (without accessories)	80 kg		
Power supply			
Voltage	88 to 264 VAC		
Power consumption	100 W		
Frequency	50 to 60 Hz		
Interfaces			
PC	USB 3.0		

[5] retrofittable

Measurement specifications	DSA100HP40	DSA100HP690	DSA100HP1750
Sessile drop/Captive bubble			
Result		contact angle	
Range [2]		0 to 180°	
Resolution [2]		0.01°	
Accuracy [3]		0.1°	
Models		conic section, polynom, circle, Young-Laplace, height-width	
Types [4]		advancing, receding, static, dynamic	
Pendant drop/Rising drop			
Results		interfacial and surface tension	
Range		0.01 to 2000 mN/m	
Resolution		0.01 mN/m	
Model		Young-Laplace	
Types		static, dynamic	

[2] software-based
[3] instrument-based
[4] additional accessories may be required

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