

THE TRACKER

FULLY AUTOMATED DROP TENSIO METER
FOR THE MEASUREMENT OF THE
RHEOLOGICAL CHARACTERISTICS OF INTERFACES



- ⇒ Stability of emulsions and foams
- ⇒ Ageing of interfaces
- ⇒ Screening of surfactants

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SET OF TENSIOMETERS

MANUAL TRACKER

For the easy measurements of the interfacial tension



HEAVY TRACKER

- Les mêmes fonctions que le Tracker standard,
- De recevoir les cellules pour les mesures à haute température et sous pression :

STANDARD TRACKER

- mesures de tension superficielle et interfaciale,
- De suivre les cinétiques de ces tensions,
- De contrôler la goutte en cours de mesure (régulation de volume, de surface et de tension),
- De mesurer les paramètres de rhéologie de surface.
- De mesurer des gouttes posées et des angles d'avancée et de recul (Plateform orientable proposée en option),
- La seringue et la cuvette d'analyse sont thermostatées par bain circulant (non fournit)

SET OF OPTIONS



SURFACE RHEOLOGY at HIGH DEFORMATION SPEEDS and HIGH FREQUENCIES

This option makes it possible to go far beyond this limit in the exploration of the dynamic behaviour of interfaces at high deformation speeds and high frequencies

CELLS for MEASUREMENT UNDER PRESSURE AND HOT CONDITIONS

Cell 200°C, electric heating

Cell 100°C, 100 bars, electric heating

Cellule à atmosphère contrôlée : pas de pression, chauffage par bain circulant

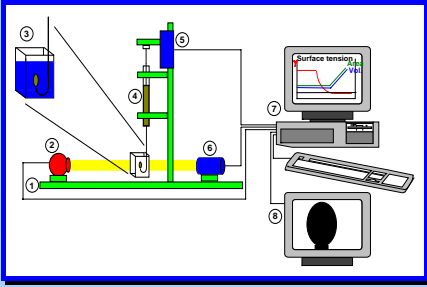


THR

SPI

Cell of interaction powder/interfacial tension,

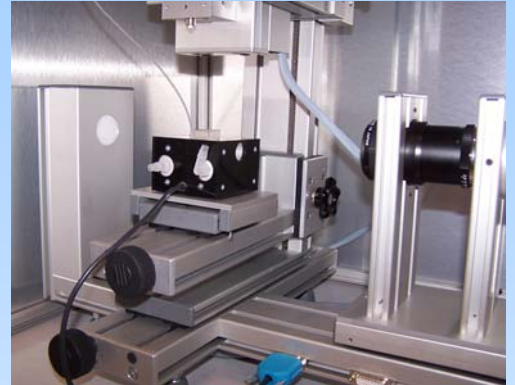
SETUP OF THE TRACKER



A light source^②, a cell (cuvette) containing the oil drop ^③, and a CCD camera ^⑥ are aligned on an optical bench^①. After the drop formation using a syringe ^④ and a motor ^⑤ for pressing down the syringe, the drop profile is digitized through the CCD camera and a personal computer^⑦. The monitor ^⑧ is used to align, check, and adjust the drop. The measurement values of area, volume and surface tension are calculated and recorded every second.

FLEXIBILITY

- measurement of low and high interfacial tension (from less than 0,1 mN/m up to more than 100 mN/m),
- fully automated instrument running under WINDOWS XP, NT, 2000
- computer assist settings,
- no correction factor,
- strong construction,
- small sample volumes
- temperature control (with bath)

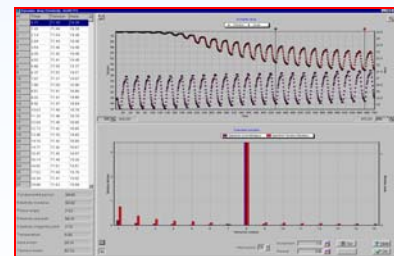


OPTIONS

- Measurement allowed in very different experimental conditions (e.g. hot conditions, under pressure).
- Measurement of the liquid/air/solid or liquid/liquid/solid contact angles in the sessile drop configuration.
- High frequencies of interface variation by ceramic
- Data processing

EXAMPLES OF APPLICATIONS

- *Stability of emulsions and foams*
- *Ageing of interfaces*
 - Detection of interfacial transformations (ex: rigidifications),
 - Competition of surfactants at the interface,
- *Characterisation of surfactant molecules:*
 - determination of CMC,
 - determination of the equation of state of interfaces covered with proteins or polymers



The **TRACKER**

is a powerful instrument allowing a better understanding
and more knowledge of interfaces

EXAMPLES OF APPLICATIONS

◆ food industry

- ⇒ development of food manufacturing Process (sauces, low fat products).
- ⇒ Quality of foams in drinks.
- ⇒ Processing of edible oils with enzymes.

◆ pharmacy

- ⇒ Development/improvement of injectable forms.
- ⇒ Metabolism of the fats in living beings.
- ⇒ Dissolution of tablets.

◆ cosmetics

- ⇒ Development of emulsions, creams, shampoos.

◆ fine chemistry

- ⇒ Paints, inks, glues.

◆ petroleum industries

- ⇒ Bitumen.
- ⇒ Oil lubrication.
- ⇒ Petroleum recovery.

SOME RELATED PUBLICATIONS

Oil Drop Tensiometer: Application for Studying the Kinetics of Lipase Actions
S. LABOURDENNE, A. CAGNA, B. DELORME, G. ESPOSITO, R. VERGER and C. RIVIERE
Methods in Enzymology, Vol 286, 306-326

Viscoelastic properties of triacylglycerol/water interfaces covered with proteins
J. BENJAMINS, A. CAGNA, E.H. LUCASSEN-REYNDERS
Colloid and Surfaces 114 (1996) 245-254

J. BENJAMINS, E.H. LUCASSEN-REYNDERS
Proteins at liquid interfaces (1998) 341-384

Surface Dilatational Rheology of Proteins Adsorbed at Air/Water and Oil/Water Interfaces
N. PUFF, A. CAGNA, V. AGUIÉ-BÉGUIN, R. DOUILLARD
Journal of colloid and interface science 208 (1998) 405-414





THE FOAMSCAN

A NEW ANALYTICAL METHOD FOR CHARACTERIZING FOAMS



- ◆ Ability of a liquid phase to generate foam
- ◆ Stability of foams

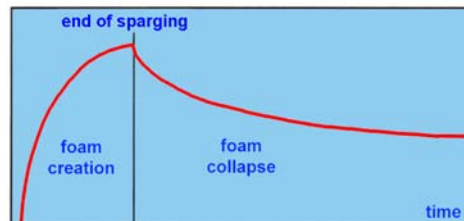
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THE FOAMSCAN MEASURES

- ◆ the ability of a liquid phase to generate foam, by measuring the volume of the foam formed by sparging from a controlled quantity of gas,
- ◆ the stability of the foam, from the variation of the volume of the foam and the drainage rate versus time.

The user defines the gas flow and the end of sparging (time or foam volume controlled). The foam is created in a glass tube and its height is measured in real time by image processing. The quantity of liquid imprisoned in the foam and the drainage rate are measured in real time from the remaining volume of the liquid phase and from the resistivity of the foam.



PERFORMANCES

- ◆ Volume of the liquid sample : < 30 ml
- ◆ Gas flow : > 500 cm³/mn
- ◆ Fully automated and computer controlled (using Windows software)
- ◆ No correction factor
- ◆ Robust construction

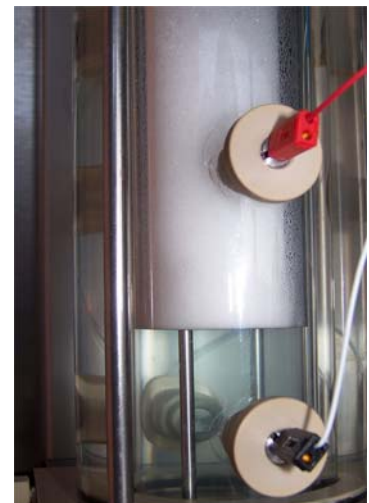
PHYSICAL QUANTITIES DETERMINED IN REAL TIME

measured

- ◆ Gas flow
- ◆ Volume of the foam
- ◆ Remaining volume of the liquid sample
- ◆ Conductance of the foam

calculated

- ◆ Density of the foam
- ◆ Bikerman index
- ◆ Volumetric stability of the foam
- ◆ Liquid stability of the foam

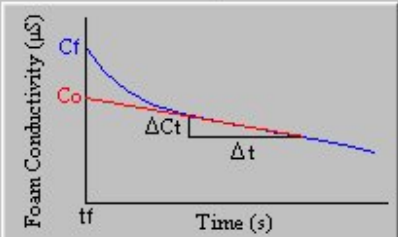


PHYSICAL QUANTITIES CALCULATED AT THE END OF THE TEST

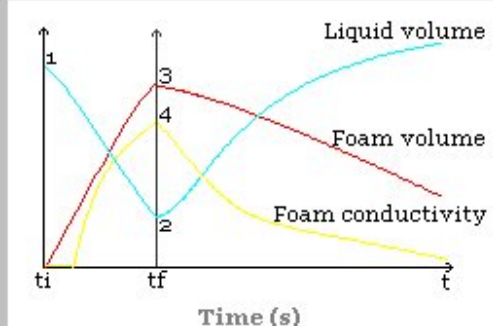
- ♦ Foam expansion coefficient
- ♦ Foaming capability
- ♦ Head retention value (RUDIN's method)

FOAMSCAN : Theoretical expressions

During foam formation	During all the experiment
<p><u>Foam Capacity :</u></p> $FC(t) = \frac{V_{t_{foam}}}{V_{t_{gas}}}$	<p><u>Foam Volume Stability :</u> (in %)</p> $FVS(t) = \frac{V_{t_{foam}}}{V_{f_{foam}}} * 100$
<p><u>Bikerman Index</u> (in s)</p> $IB(t) = \frac{V_{t_{foam}}}{D_{f_{gas}}}$	<p><u>Foam Liquid Stability :</u> (in %)</p> $FLS(t) = \frac{V_{i_{liq}} - V_{t_{liq}}}{V_{i_{liq}} - V_{f_{liq}}} * 100$
Final foaming	
<p><u>Foam Expansion :</u></p> $FE = \frac{V_{f_{foam}}}{V_{i_{liq}} - V_{f_{liq}}}$	<p><u>Foam Density Stability :</u> (in %)</p> $FDS(t) = \frac{C_{f_{foam}}}{C_{f_{foam}}} * 100$
<p><u>Foam Capacity :</u></p> $FC = \frac{V_{f_{foam}}}{V_{f_{gas}}}$	
<p><u>Relative foam Conductivity :</u> (in %)</p> $C_f = \frac{C_{f_{foam}}}{C_{f_{liq}}} * 100$	
<p><u>Foam Maximum Density :</u></p> $MD = \frac{V_{i_{liq}} - V_{f_{liq}}}{V_{f_{foam}}}$	
<p><u>Bikerman Index :</u> (in s)</p> $IB = \frac{V_{f_{foam}}}{D_{f_{gas}}}$	
<p><u>Foam Stability Index :</u> (in s)</p> $FSI = C_0 * \frac{\Delta t}{\Delta C_t}$	




Abbreviations



t_i : Initial time, Start of experiment
 1 : $V_{i(liq)}$ -> Initial liquid volume
 t_f : Time to stop foaming
 2 : $V_{f(liq)}$ -> Final liquid volume
 3 : $V_{f(foam)}$ -> Final foam volume
 4 : $C_{f(foam)}$ -> Final foam conductivity

$D_{f(gas)}$: Final gas flow
 $V_{f(gas)}$: Final gas volume inject

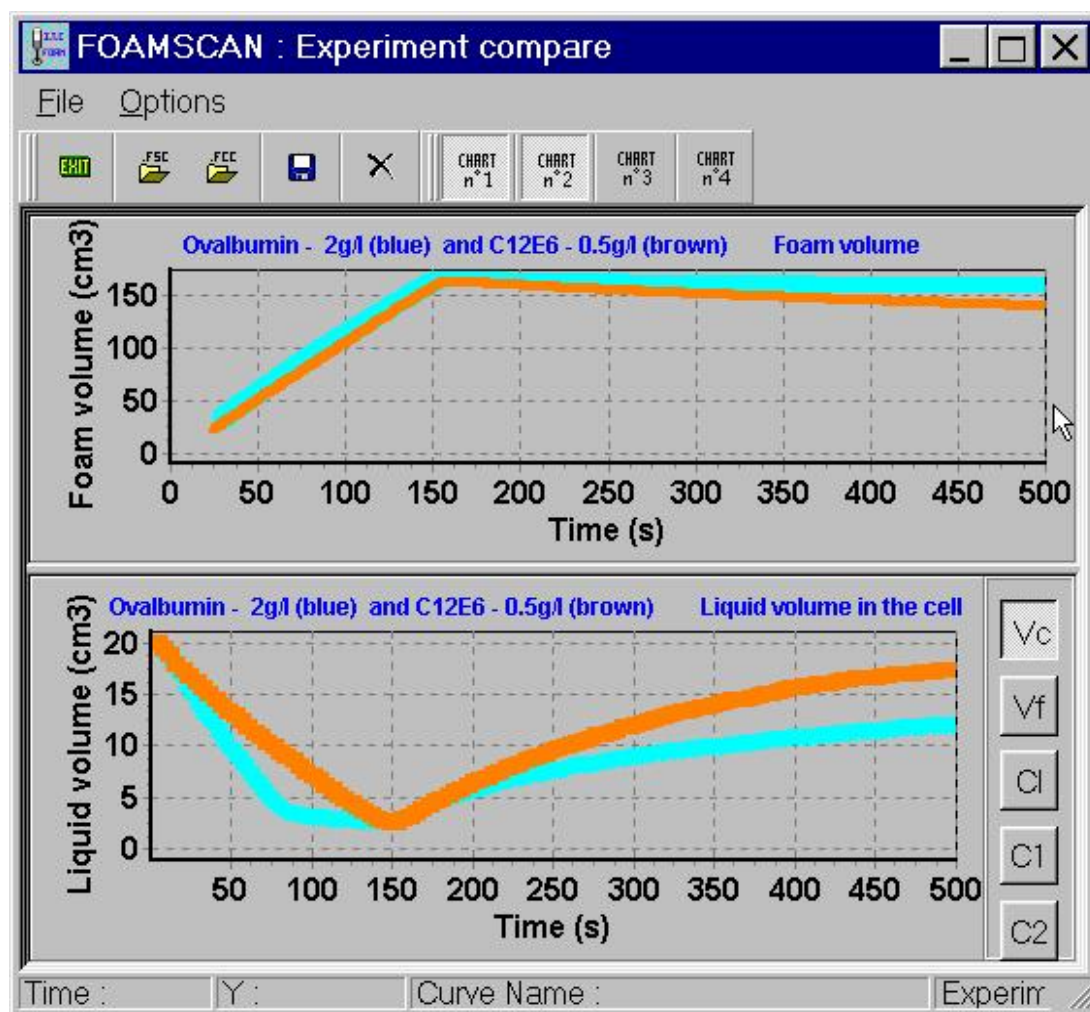
(V : Volume ; C : Conductivity ; D : Flow ; t : Time)



OPTIONS

- ⇒ Generation of foam by stirring,
- ⇒ Introduction of surfactants during the experiments,
- ⇒ Recirculation of fluids

COMPARISON OF RESULTS (EXAMPLE)



SOME RELATED PUBLICATIONS

* JOURNAL OF TEXTURE STUDIES 24 (1993) 287-302.

Study of Foam stability by video image analysis : relationship with the quantity of liquid in the foams.

C. Guillerme, W. Loisel, D. Bertrand, Y. Popineau.

Institut National de la Recherche Agronomique de NANTES (France).

* FOOD HYDROCOLLOIDS – Vol. 11 n° 1 pp.59-62, 1997.

Foaming properties of a natural cyclic lipoheptapeptide belonging to a special class of amphiphilic molecules.

H. Razafindralambo^a, M. Paquot^a, A. Baniel^b, Y. Popineau^b, C. Hbid^c, P. Jacques^c, P. Thonart^c.

^aFaculté Universitaire de GEMBLOUX (Belgique) , ^bInstitut National de la Recherche Agronomique de NANTES (France), ^cUniversité de LIEGE (Belgique).

* LANGMUIR, 13 (23) (1997) 6026-6031.

Surface-active properties of surfactin/iturin A mixture produced by Bacillus subtilis.

H. Razafindralambo^a, Y. Popineau^b, M. Deleu^b, C. Hbid^c, P. Jacques^c, P. Thonart^c, M. Paquot^a.

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