dataphysics
Understanding Interfaces

Fast and easy to use determination of surface energy of solids with the new Double Liquid Jet system DLJ for the OCA series from DataPhysics Instruments.

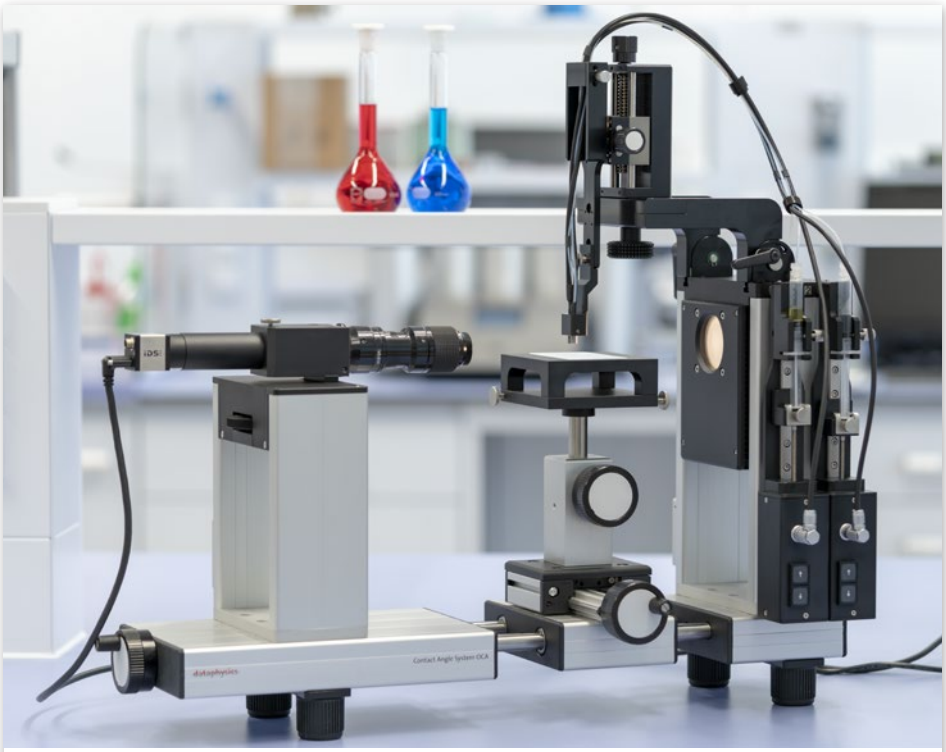

Fig. 1: DataPhysics Instruments OCA 25 with Double Liquid Jet system DLJ

Background

The surface energy of solids is the significant property that is used to verify a successful pretreatment or cleaning process of a solids surface. Furthermore the knowledge of the surface energy facilitates an estimation of the wetting behaviour and adhesive properties of the solid for further processing.

In order to analyse large quantities of samples, often the case in quality control, an easy to use and fast determination of the surface energy is a fundamental requirement.

With the Double Liquid Jet system DLJ DataPhysics Instruments offers the possibility to determine the surface energy with one-click using the optical contact angle measuring and contour analysis systems of the OCA series by simultaneously dosing two liquids and measuring their contact angles.

Measuring method

For the surface energy determination of a polymer sample, water and diiodomethane were used as test liquids. The purity of the test liquids was tested beforehand according to the pendant drop method using the same measuring system.

The Double Liquid Jet system DLJ was filled with the test liquids and was used with an optical contact angle measuring and contour analysis system OCA 25 (see Fig. 1) and controlled by the corresponding SCA software.

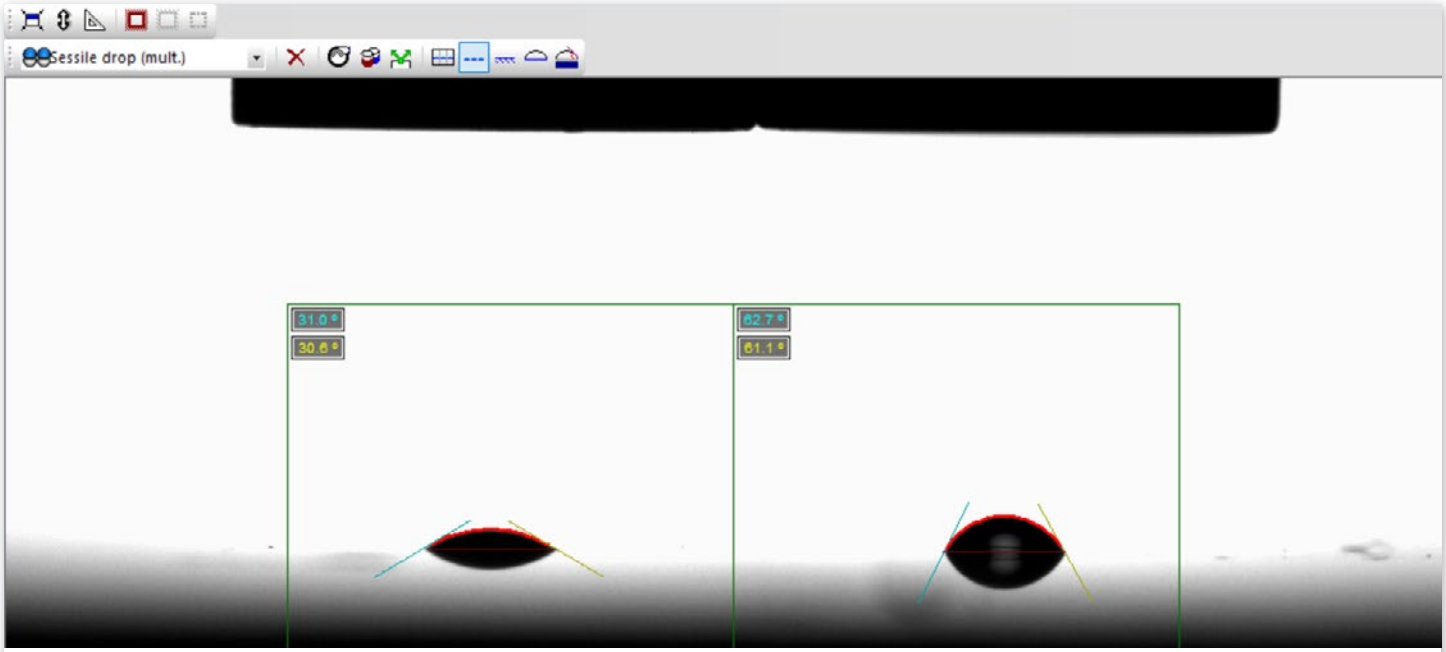

Fig. 2: camera image of the diiodomethane drop (left) and the water drop (right) with evaluated contact angles

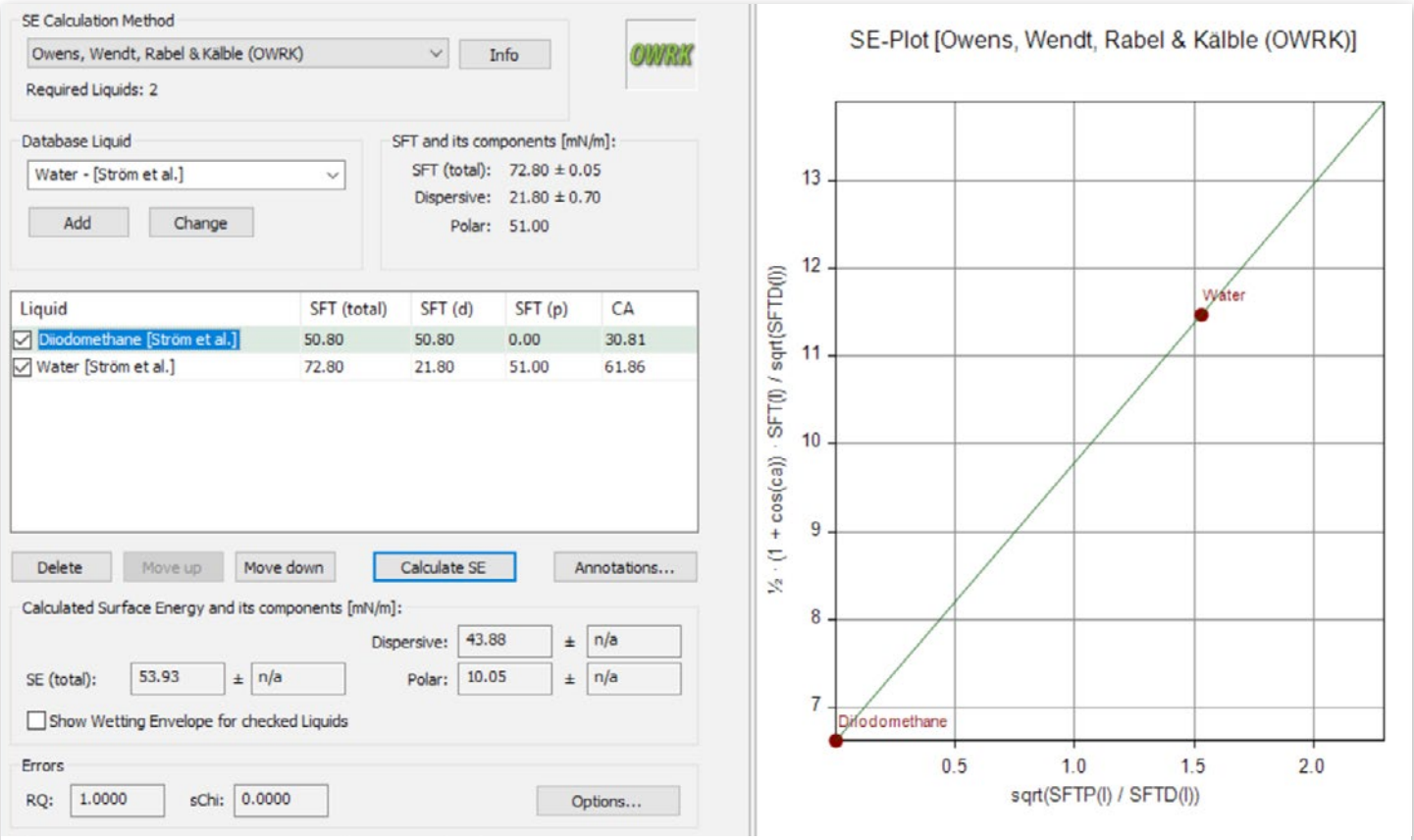

Fig. 3: evaluation of the surface energy with the SCA software

With the "One-Click-SE" method of the SCA software, at the push of a single button both test liquids are simultaneously dosed on the investigated surface, the contact angles of both liquids are evaluated (see Fig. 2) and the surface energy is determined according to the OWRK method [1-3] (other methods are possible as well). Finally the surface energy including its polar and dispersive components is presented in a result window (see Fig. 3).

Results

The coated polymer sample has a surface energy of σ = 53.93 mN/m (polar component: σ^p = 10.05 mN/m; dispersive component: σ^d = 43.88 mN/m).

The overview diagram of the SCA software is shown in figure 3. The optical measurements of the contact angles of diiodomethane (θ = 30.8°) and water (θ = 61.9°) are shown in figure 2.

Summary

The Double Liquid Jet system DLJ in combination with the optical contact angle measuring and contour analysis system OCA and the SCA software from DataPhysics Instruments, enables the determination of the surface energy of a solid with one click. Two test liquids are simultaneously dosed onto the solid surface, the contact angles evaluated and the surface energy including its polar and dispersive parts is determined.

Due to its design the system is not restricted to the test liquids diiodomethane and water. Hence, the surface energy determination can even be done on samples that react with water or diiodomethane.

Without the need for additional accessories the purity of the used test liquids can be tested by surface tension measurement according to the pendant drop method.

Furthermore the DLJ system offers the ability to flexibly adjust the size of the dosed drops so even the smallest sample surfaces and component parts can be analysed.

In summary the DLJ system enables a time saving, easy to use and reliable analysis of the surface energy.

Literature

[1] Owens, D. K. and Wendt, R. C. (1969), Estimation of the surface free energy of polymers. J. Appl. Polym. Sci., 13: 1741-1747.
[2] D. H. Kaelble (1970) Dispersion-Polar Surface Tension Properties of Organic Solids, The Journal of Adhesion, 2:2, 66-81.
[3] W. Rabel, Einige Aspekte der Benetzungstheorie und ihre Anwendung auf die Untersuchung und Veränderung der Oberflächeneigenschaften von Polymeren. In: Farbe und Lack 77,10 (1971), S. 997-1005.

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