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Application Report

Fountain Solutions for Offset Printing

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Method: 

Bubble Pressure Tensiometer – BP2

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Fountain Solutions for Offset Printing

Fountain or dampening solutions in offset printing technology are used to protect non-imaging areas of the printing plate from wetting with ink. Non-imaging areas of the printing plate are formed by aluminum substrates mostly surface treated to enhance their wettability. Usual fountain solutions consist of water and isopropanol (IPA). In the past 10 to 30% of this solution was IPA. Nowadays due to environmental and safety awareness IPA is more and more substituted by less volatile soluble organic compounds (nevertheless some of them hazardous) like glycols but always in combination with surfactants or surfactant-like substances.

In a solution consisting of 30% IPA the surface tension is about 30mN/m at nearly every timescale even at short times. This is because IPA has got a high concentration, it is completely miscible with water and a small molecule so it can diffuse very rapidly to the freshly built surface. Glycols and surfactants have molecular weights and sizes several times larger than IPA, but the major advantage of surfactants is the extreme small amount of substance needed to lower surface tension effectively. In equilibrium just ppb to ppm amounts are needed to achieve surface tensions in water of around 30mN/m. But due to the molecular weight and size they diffuse and absorb much slower to and at the freshly built surface.

In offset printing technology no equilibrium conditions for the liquids are given. Surfaces are built and destroyed within milliseconds. So when trying to substitute IPA by other components to lower the surface tension of water for this purpose effectively, one should not take static or equilibrium surface tension into account, but dynamics.

The difference between static and dynamic methods is the measurement procedure itself. At a static measurement the expansion of surface takes place once in the beginning of the measurement. The surface is somehow pre-equilibrated since it has been poured into the beaker and after a not defined period of time the measurement took place. So a static measurement can give information about the equilibrium surface tension and the decrease of surface tension with time between start of the measurement and the end (which is the equilibrium if the time was long enough).

In a dynamic experiment the enlargement of surface is part of each measurement and takes place in a defined way (time and size). So the result of a dynamic measurement is always at least a pair of data: surface age and surface tension (which belongs to this specific surface age). Usually the surface age is varied during a series of measurements, so a plot of surface tension vs. surface age is the result.

In the following example two samples of fountain solution concentrate "good" and "bad" have been tested towards their ability to lower surface tension of water when diluted to give 2% and 3% solutions of concentrate in water. (The concentration of surface active compounds in the concentrates usually is about 10%, so there is about 0.2-0.3% surface active matter in the solution used in practice). Here no equilibrium measurements were performed, since for the printing process this data would not be valuable. For characterization of the dynamic properties of these samples the KRÜSS maximum bubble pressure tensiometer BP2 was used.

Diagram 1 shows the dynamic surface tension of 2wt-% and diagram 2 3wt-% solutions in water.

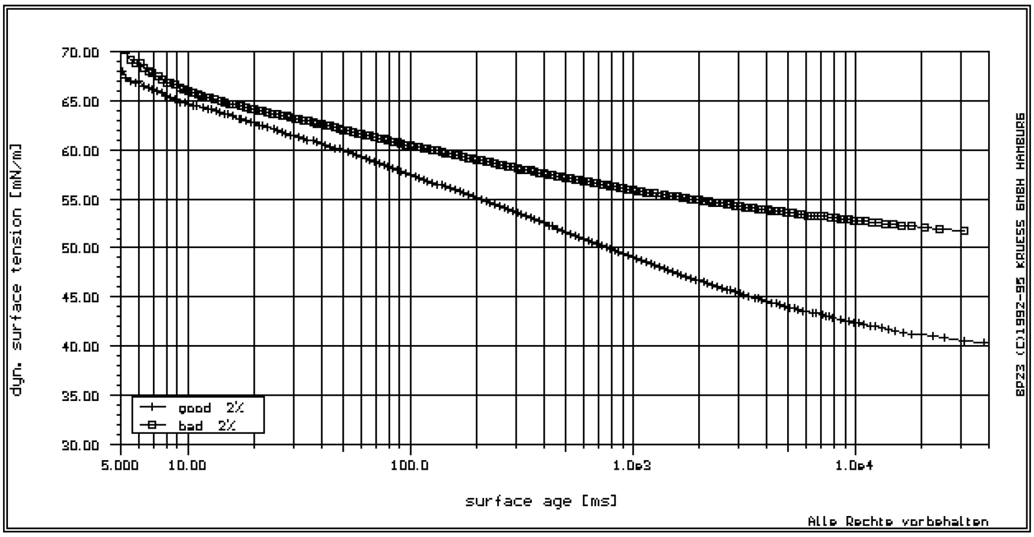

Diagram 1: dynamic surface tension versus time of samples "good" and "bad" (2wt-% in water)

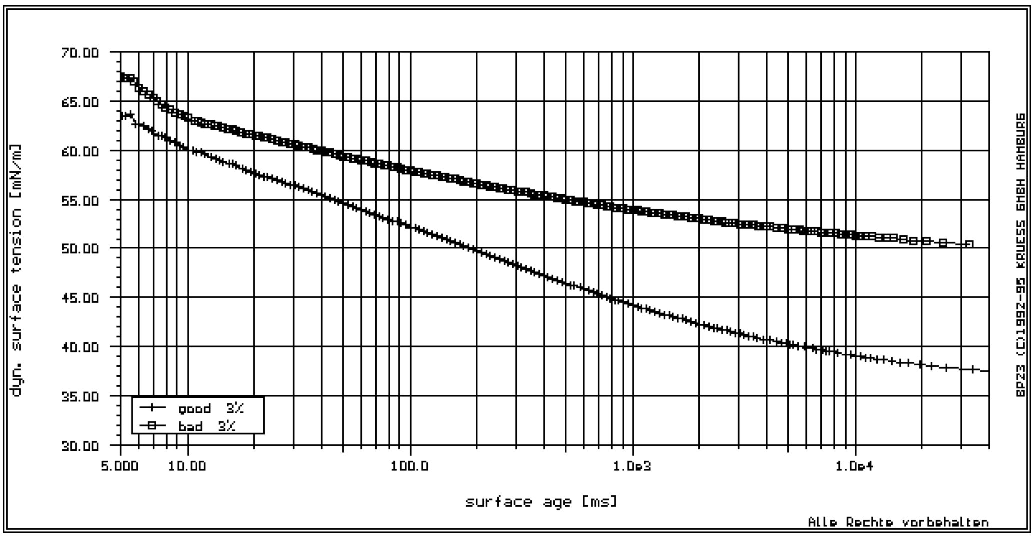

Diagram 2: dynamic surface tension versus time of samples "good" and "bad" (3wt-% in water)

As can be seen in the diagrams both samples show strong dependence of surface tension from surface age. Sample "bad" lowers surface tension only effectively at high surface ages. The slope of sample "good" is smaller (more negative) so it is able to lower surface tension more effectively within smaller time frames. This effect is even strengthened when increasing the concentration to 3wt-% (see diagram 2).

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