Application Note #6

Evaluation of test results of ink / water emulsification capacity tests with the LITHOTRONIC

1. Computer support simplifies data evaluation

In R & D and quality control applications a large number of test results are available after certain time. Graphical curve comparison and evaluation is possible but can be very time consuming especially for larger number of curves. That's why it may be useful to characterize curves also by a small number of parameters, that can be saved in a spreadsheet table or data base and simplify the curve evaluation and the study for special properties.

What are the essential test parameters, which describe the principal behavior of the ink under test?

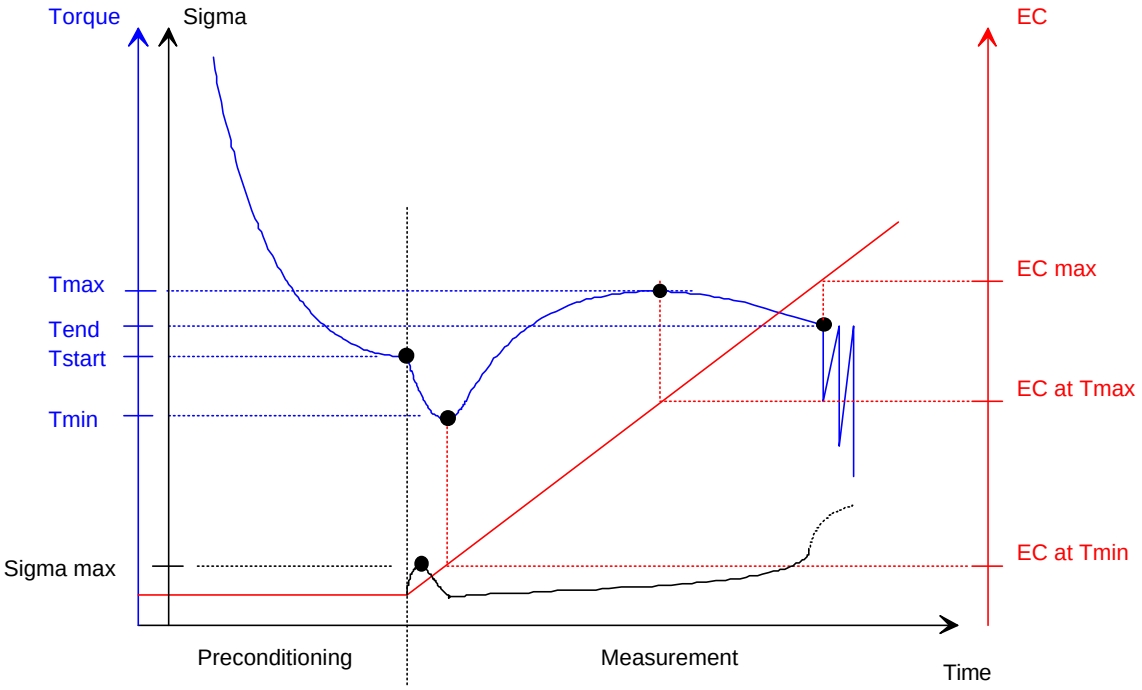

Fig. 5: Essential points of the test

2. Quantification of result curves

1) Start-Torque (Tstart, 0)
   Indicates the torque immediately before starting the water dispension. Because the torque value is related to the viscosity of ink, a viscosity index value is obtained from this parameter.

2) Sigma Curve and Sigma-max
   The mathematical standard deviation Sigma will be calculated over the past 5 seconds. Noise on the torque curve increases the sigma value, a smooth curve decreases the sigma value. So the sigma value is an objective parameter for the curve stability. Generally a noisy curve indicates an ink is hydrophobic and not capable to emulsify new water. A smooth curve can be caused by hydrophilic character of the ink and by a higher water pick-up rate. These effects may investigated in detail by varying the dispension speed during the test series.

The initial jump in the Sigma-max point is related to the first torque dropimmediately after water dispension start. These two parameter may help to characterize the water repellent behaviour of the ink during the first ink-water interaction.

3) Torque-min (Tmin, EC at Tmin)
   Indicates the minimal torque (and viscosity) immediately after start of water dispension. The Torque min-and Sigma-max may indicates commonly the quality of first ink-water interaction.

4) Torque max (Tmax, EC at Tmax)
   Indicates the maximal torque (and viscosity) versus amount of water.

5) EC max (T at ECmax, ECmax)
   Indicates the maximal amount of water pickup. The maximal amount of water is strongly effected by the applied test conditions. Generally higher temperatures and slower shear rates increase the emulsification capacity. The dependency on temperature and shear rate is important and can be investigated when these parameters will be varied in a test series.

6) Delta Torque
   Indicates difference between Tmax and Tstart and thus the dependency of torque (and viscosity) versus emulsification capacity.

Not every ink-water balance test shows all listed points significantly. It depends on the quality of micro-emulsion how and whether the torque increases versus EC. Diluting effects can be superposed and may show a smaller or larger decrease in torque. Also in the behavior of the first ink-water interaction there are differences that can be taken into account for ink-water balance characterization.

3. Rheology and ink/water balance

Systematic studies on ink/water behaviour of inks have been carried out by several European ink manufacturers as round robin tests organized by the working group on water-balance (wow-group) of EUROCOMMIT which is the European committee for standardization of ink test methods.

For detailed information on this matter, copies of publications are available from NOVOMATICS. Recently similar work is done in America by the ASTM working group to develop a standard test method for emulsification assessment of lithographic inks utilizing the LITHOTRONIC tester under the designation ASTM-WK1451. Chairman of this working group is Peter Ford of Sun Chemical (Fordp@sunchem.com).

