

## ADVANCED RHEOLOGICAL AND TRIBOLOGICAL METHODS FOR COSMETIC PRODUCTS

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Many different rheological procedures can be used to tailor cosmetic products in a way that they meet the desired properties. Simple flow curve measurements reveal the viscosity at shear rates prevailing at processing conditions. Strain sweep give information on the strength of the rest structure and the amount of elasticity. The end of the linear visco-elastic range which is measured in a strain sweep is in a direct correlation to with the yield stress and flow point which need to be overcome in order that a gel like material starts to flow. A frequency sweep can help to gain information on the time dependence of relaxation processes. The higher frequency for example correspond to the application of a cream and lower shear moduli relate to a smoother, creamier less solid consumer experience. Difference at lower frequencies might indicate if a sample in a container flows back to a smooth surface after removing part of the sample or not and how fast such a process is.

Indications on long time stability of cosmetic samples can be gained by a so-called temperature swing test in which the temperature is frequently varied between to values and the rheology response over time is followed.

While rheology provides information on stability, flowability, temperature behavior, and sensory attributes like volume, smoothness, and firmness of a cosmetic product, tribology simulates more directly the application process of, for example, a cream on the skin. Since the forces and sliding speeds are rather small in cosmetic applications a tribology setup based on a rotational rheometer with its capability of applying small rotational speeds and normal loads as well as measuring small torques is well suited to perform friction measurements of cosmetic materials. A ball on three pins setup was used with a glass ball and pins made of PDMS to mimic the skin. Stribeck curves, i.e. friction factor measurements over an extended range of sliding speeds, have been performed on various cosmetic materials such as skin creams and sun creams. Differences between different samples are identified and discussed. An alternative approach is the use of a bottom layer of artificial skin and rounded pins which slide on top of the skin layer.

Various rheological and tribological methods are presented and discussed for different cosmetic applications. Rheology and tribology are shown to be helpful tools to assist the formulation of cosmetic products.