

NEW TECHNOLOGIES FOR COSMETIC APPLICATIONS

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Acoustic levitation: possible applications for cosmetics

Levitation techniques are being increasingly used in materials science [1]. The principle of acoustic levitation is to use an ultrasonic wave to counteract gravity. Typical frequencies are on the order of a few tens of kHz. Basically, an acoustic wave is generated by a transducer and reflected on a curved metallic reflector. This creates pressure gradients in the surrounding atmosphere at each node of the wave, enabling non-contact positioning and manipulation of solid and liquid samples in the size range of 1-3 mm. Our system, illustrated in the figure, has been developed by Material Developments Inc. (Arlington Heights, IL, USA). It uses two transducers instead of one, providing improved stability. Its working principle is described in detail in ref. [2]. Various kinds of liquids can be levitated and particularly pharmaceuticals [3] and possibly cosmetics. By removing the container, the acoustic levitation makes it possible to directly study drying phenomena, the stability of formulations, and the effects of external perturbations on conservation, dehydration and aging. In particular, the effects of various environments can be studied: - Temperature, in the range -40° to $+40^{\circ}$ - Surrounding gas (air, CO₂...) - Light (as a function of intensity and wavelength: UV, visible...) - Humidity (dehydration, saturation...) For all these environments, it is also possible to study the influence of bio-protectors or stabilizing agents. In this talk, the potential applications of acoustic levitation for cosmetics and pharmaceuticals will be discussed and recent results will be presented.

- [1] D. L. Price, High-Temperature Levitated Materials (Cambridge University Press, 2010)
- [2] J .K. R. Weber, C. A. Rey, J. Neufeind, C. J. Benmore, "Acoustic levitator for structure measurements on low temperature liquid droplets," Rev. Sci. Instrum. 80, 083904 (2009).
- [3] C. J. Benmore, J. K. R. Weber, A. N. Taylor, B. R. Cherry, J. L. Yarger, Q. Mou, W. Weber, J. Neufeind, S. R. Byrn; "Structural characterization and aging of glassy pharmaceuticals made using acoustic levitation," J Pharm. Sci. 102, 1290-1300 (2013)