

The Sonorheometer: Real-Time Rheology under Sonication

Kaja Liepert¹, Stefan Baudis^{1,2}, Davide Ret¹, Robert Liska¹, Patrick Knaack¹

¹ Institute for Applied Synthetic Chemistry, Technische Universität Wien, Getreidemarkt 9, 1060 Vienna, Austria

² Christian Doppler Laboratory for Advanced Polymers for Biomaterials and 3D Printing, Technische Universität Wien, Getreidemarkt 9, 1060 Vienna, Austria

Ultrasound (US) has become an increasingly valuable tool in both industry and research, with applications ranging from controlled drug release to the modulation of formulation viscosity. To investigate the rheological properties of samples upon ultrasonic stimulation, we have developed a novel setup, allowing *in situ* rheological measurements during ultrasonication. The Sonorheometer is based on a conventional rheometer with a plate–plate geometry, integrating a custom-designed bottom plate, allowing the fixture of an ultrasonic transducer (28 kHz or 1MHz) and introduction of the corresponding trigger into the sample. The transducer is, hereby, driven by a continuous sine wave using a waveform generator in combination with a custom-build power amplifier optimized for the low-kHz range. Implementation of a PTFE-stamp, replacing conventionally used metal stamps, provides advantageous damping properties while maintaining chemical and thermal stability. Ultrasound in the low kHz-range has demonstrated great potential for viscosity reduction in various thixotropic systems, as reported in the literature.^{1,2} This work presents the influence of ultrasound on the rheological properties of diverse everyday commodities, showcasing industrially relevant examples and outlining potential applications for this innovative measurement device.

Acknowledgement: Christian Doppler Research Association, Austrian Federal Ministry of Economy, Energy & Tourism, National foundation for Research, Technology & Development.

¹ Ngoc, N. L.; Takaomi, K;. Ultrasound stimulus effect on hydrogen bonding in networked alumina and polyacrylic acid slurry. *Ultrason Sonochem* 2010, 17 (1), 186-192. DOI: 10.1016/j.ultsonch.2009.04.007

² Venegas-Sanchez, J. A.; Tagaya, M.; Kobayashi, T;. Effect of ultrasound on the aqueous viscosity of several water-soluble polymers. *Polymer Journal* 2013, 45 (12), 1224-1233. DOI: 10.1038/pj.2013.47