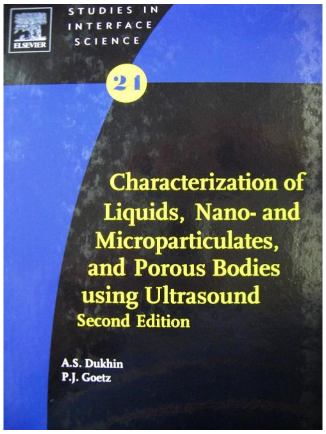
Dispersion Technology Inc. Newsletter #24

Second Edition



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Preface to the second edition:

"Ultrasound for characterizing colloids" was first published in 2002. We decided to work on the second edition after two print runs were sold out and the book became unavailable. By the beginning of 2008, we gathered substantial justifications to prepare a new edition of the book instead of running an extra print of the first edition.

First of all, there were about 40 papers published by users of our instruments in various scientific journals. There was, in addition, about a dozen of our own papers and several papers published by other scientists in the field. These papers demonstrated the wide spectrum of applications for characterization methods by ultrasound.

Second, we discovered promising ways of using ultrasound that were known in specific scientific areas but not to us. We didn't mention them in the first edition and wanted to rectify the situation. One of the most striking examples was "seismoelectric current". This electro-acoustic and electrokinetic phenomenon has been known in geology for 70 years. However, there is practically no information about it in the major books on colloid and interface science despite the fact that it can be defined as "streaming current that is non-isochoric at ultrasound frequencies". Frenkel's theory of this effect is the first electroacoustic theory (1944) known to us while Ivanov's experiment is dated about the same time (1940) along with the first electroacoustic experiments by Hermans (1938). We present detailed descriptions, both theoretical and experimental, of this little known electrokinetic effect in Chapters 5 and 13.

Seismoelectric current may become important in characterizing porous bodies. It clearly offers a simple way to measure ζ-potential in pores. In addition, it offers the possible opportunity to characterize porosity and pore sizes.

Another important example of discoveries in old works is "longitudinal rheology" and a host of related applications. Interpretation of acoustic data in rheological terms opens many new ways for applying ultrasound for characterizing complex systems. Mason predicted this 50 years ago for polymer solutions. There were other enthusiasts but the lack of instruments and systematic reviews brought this field to a complete stop. We present here a review of the many works in "longitudinal viscosity" and provide some applications of our acoustic spectrometer as a "longitudinal rheometer". One of the most important applications is

the measurement of the "bulk viscosity", an obscure second-viscosity coefficient of regular Newtonian liquids.
Another example is Passynski's theory (1938) that relates the speed of sound with size and solvating number of ions. This theory was used by Bockris and others 40 years ago but has been since neglected. There are many talks about measuring nanoparticles with sizes down to 1 nm using dynamic light scattering. This was done many decades ago using sound speed measurements with appropriate theoretical treatments. We discuss this in the Chapter 12.
There are several other new sections in the second edition. Most of them are on applications described in Chapters 8-13 but there are some new theoretical developments discussed in Chapters 3-5 as well.
This field has become so wide-ranging in methods and applications that we begun talking more about the versatility of ultrasound for characterization purposes. This is explored in Chapter 1.
This second edition is almost twice in size and has 50% more references than the first one. In preparing the first edition, we made the statement that it "... marked the end of ultrasound's 'childhood' in the field of colloids...". This second edition marks the beginning of adulthood. The number of groups working with our instruments has increased from 100 to 350. Geography has become much more diverse. In addition to the U.S., Germany, Japan, Taiwan, China, U.K., Belgium, Finland, Singapore, South Korea, Mexico, and Canada, we have now users of our instruments in the Netherlands, Brazil, Thailand, Malaysia, India, Russia, Lithuania, Austria, Switzerland, Italy, Spain, France, Czech Republic, Columbia, Kuwait, Australia, and South Africa.
We would also like to express our gratitude to our international agents: Quantachrome GmbH (Europe), Nihon Rufuto (Japan), Horiba U.S.A., Acil Weber (Brazil), Advantage Scientific (China), and LMS (S.E. Asia). Without their dedication, we would not have been able to achieve so much in such a short period of time. They learned these new methods and now actively promote and teach them to others.
We would like also to mention the contributions from our colleagues at Dispersion Technology: Betty Rausa, Lazlo Kovacs, Ross Parrish, Kenneth Schwartz, and Arthur Sigel. By taking proper care of everyday problems and the company's needs, they gave us time to write this second edition.

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