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## In situ ultrasonic measurements: A powerful tool to follow the synthesis of zeolites from coal fly ash

Theory of crystal growth in the hydrothermal synthesis of zeolites is provided by a great number of mechanistic aspects and modelling studies. In this context, *in situ* ultrasonic measurements as a real-time, *in situ* diagnostic tool is able to monitor changes in the synthesis including incubation and crystallization period in both the liquid and solid phase. It could be shown that diagnostic ultrasound can be used as a tool to calculate kinetic data but also to settle ex situ techniques, such as XRD, ICP and SEM at predicted times to complement the results of the kinetic study, in our case synthesizing zeolites from fly ash. Class F coal fly ash for our studies, was supplied by ESKOM as basis to scale up laboratory results. Although the used ultrasound technology is not a structure-sensitive method of analysis, important information can be obtained from the results concerning the start, course and end of crystallization, which was proven not only at laboratory scale. Reaction rate, reaction order, and activation energy for the crystallization from clear solution were calculated on the basis of ultrasound signal data recorded at different crystallization temperatures. On the basis of measured data it can be detected if there are germs acting in the system to favour competing crystal growth. It should be mentioned that the access to the period of first crystal growth is far more accurate than other techniques demonstrating experimental handicaps.

## **Biography**

Erich Joseph Hums studied in Berlin, Germany both Chemical Engineering and Chemistry. He has completed his PhD at the University in Bayreuth, Germany. He was consulting technical innovations, support to R&D, patent/license strategy and pioneering the development of the so-called plate-type catalyst for NOx abatement at the Siemens Company. He was lecturing at the University Halle-Wittenberg/Germany. Thereafter, he started consulting with companies and universities and serving as an Editorial Board Member of Applied Catalysis B Environmental. He has been instrumental in assisting to achieve industrial collaboration in the emerging science area in South Africa on the fly ash side for UWC/ESKOM. He has published numerous patents, papers and articles.

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