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soniccatch – accurate measuring solutions

Ultrasonic particle manipulation for crystallization processes

Benefits of using soniccatch:

- Quality in-line data
- Process monitoring in real-time
- Enhanced signal intensity
- Improved robustness due to in-line cleaning

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Ultrasound enhanced crystallization monitoring

Crystallization is a process that involves the formation of solid crystals from a liquid or gas phase. It is one of the most widely used technologies in chemical industry, as it can offer several advantages such as separation, purification, and solid form selection. In the following we will discuss opportunities for improving the crystallization process and its applications using in-line probes and the sonic**catch** technology.

Crystallization can influence the properties and performance of the final products, such as their **purity, stability**, **solubility**, **bioavailability**, and **morphology**.

Crystallization involves complex phenomena such as nucleation, crystal growth, crystal size distribution, polymorphism, and crystallizer design and operation. These factors can affect the **quality** and **yield** of the crystals, as well as the **efficiency** and **economics** of the process. Therefore, it is essential to understand and control the crystallization process to achieve the desired outcomes.

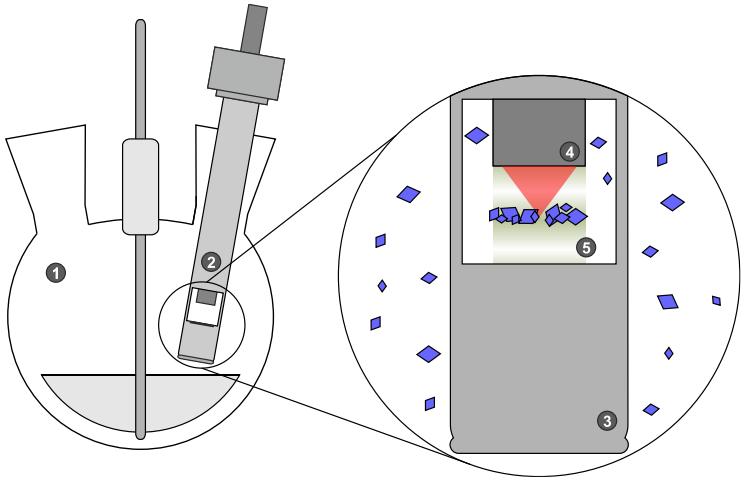


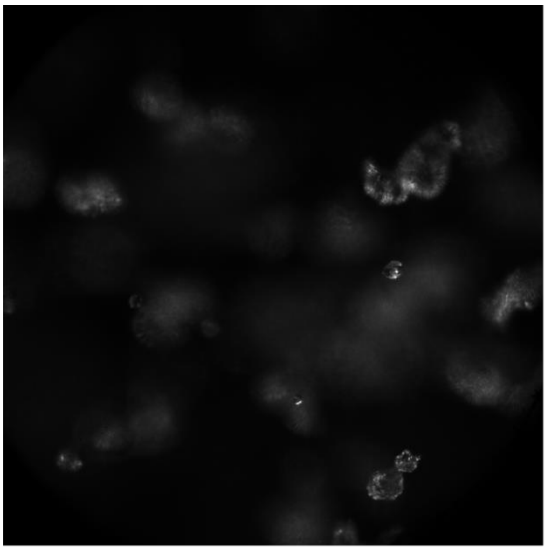
Image 1: Typical glass reactor (1) with the sonic**catch** (2) add-on and probe inserted. The inset shows the ultrasonic trap formed by the transducer (3) and the in-line probe (4), e.g. a Raman, ATR or microscope probe. Particles are caught in the trap (5) and can now be measured accurately.

1 Particle tracking with improved sensitivity

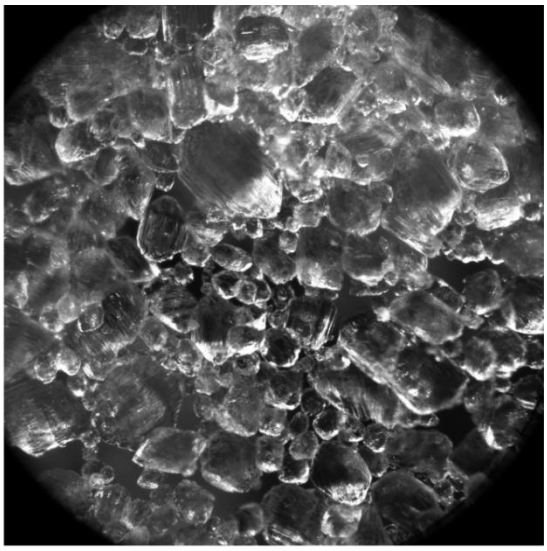
With sonic**catch**, crystals can be trapped in the focal point of the probe, significantly increasing the specific information.

Monitoring crystallizations with in-line microscopes can be used to effectively track crystal size, which yields a lot of information on the process. Furthermore, an integrated solution is available from **BlazeMetrics**, which combines image retrieval and the acquisition of **Raman spectra** in a single probe.
This provides the user with additional information through the spectroscopic data on e.g., crystal structure. Due to the inherent insensitivity of Raman, it is difficult however to obtain specific information of the crystal, especially in the beginning of the crystallization.

The following image comparison shows the effect of activating the ultrasonic trap:



sonic**catch** off



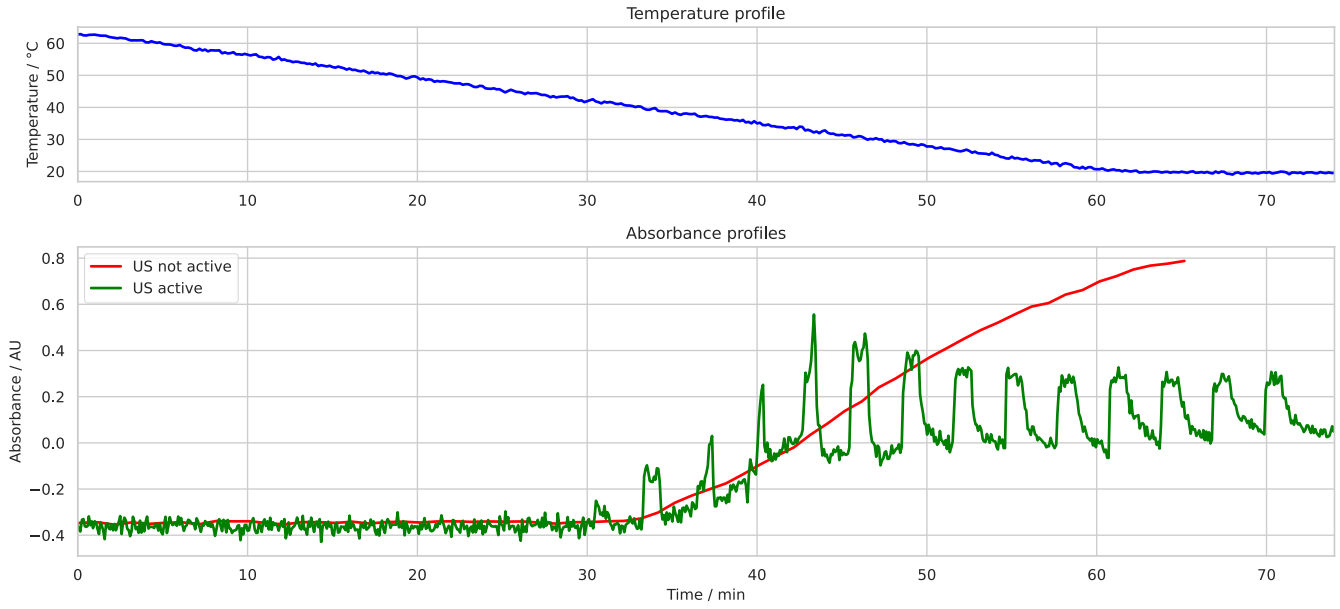
sonic**catch** on

Image 2: The ultrasonic trap focuses the crystals into the focal plane of the in-line microscope, thereby producing a sharp image with a significantly higher number of crystals.
The increased particle count yields in a better particle size distribution statistic. Simultaneously, the Ra-man signal of the crystal is enhanced, which allows for a more sensitive detection of crystals structure, e.g., for the detection of polymorphs.

2 Improving selectivity for in-line ATR-FTIR probes

sonic**catch** can effectively control the position of the caught crystals in such a manner, that they are either pushed into the evanescent field of an ATR probe or kept out of it.

Since **ATR probes** are only sensitive in a µm thick layer above the probe tip, blocking of this sensitive area by crystals leads to spectra, which aren't representative of the process current state. With sonic**catch**, it is possible to control the position of the caught crystals.



A typical crystallization process without sonic**catch** is represented by the red line in the figure above. The crystal-specific signal in the spectra rises steadily as the tip of the ATR probe is coated with crystals. The green line shows the intensity profile of the same feature with the distinction of an active sonic**catch**, which is alternately switched between "**pushing**" and "**retracting**" mode. The "retracting" mode keeps crystals from attaching to the tip of the probe, thus providing a stable background even with high solid load and vigorous stirring. The ultrasonic add-on can conversely be used to clean probes in-situ.

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