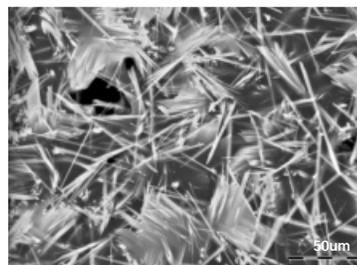


# In-Situ Examination of Hydration Processes

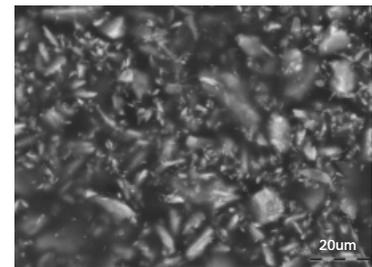
In-situ studies of hydrated systems, such as cement or gypsum, can now be carried out inside any Scanning Electron Microscope by applying QuantomiX proprietary WETSEM™ Technology. The sample is placed in a sealed specimen capsule under atmospheric pressure. The “as prepared” water to powder ratio is maintained, and the hydration process is unaffected by the vacuum in the SEM chamber. WETSEM™ technology is based on a vacuum tight capsule with an electron transparent window through which the imaging is carried out. The wet sample can be placed and observed in a conventional SEM without the need for drying, freezing or employing low pressure or environmental SEM.

## Gypsum Hydration

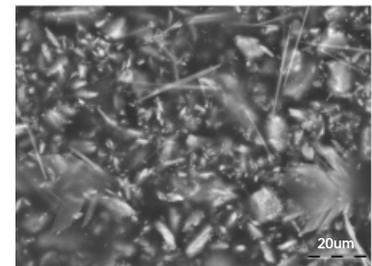
Early stages of gypsum hydration can be imaged with a conventional SEM using a QX-202C capsule, as shown on the right. The growth of needle like crystals can be followed in the sequence of micrographs. Images were taken at 8, 16, 24, and 60 minutes. The formation of a network of gypsum crystals is evident within the first hour of observation.



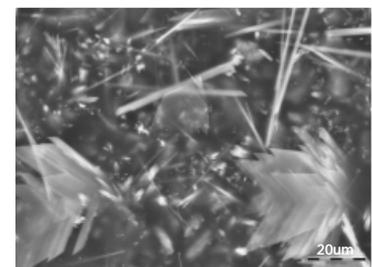
60 min



8 min



16 min



24 min

## Cement Hydration

Early age hydration reactions of cementitious systems are crucial factors in controlling properties such as workability retention and setting. These reactions have a significant impact on the properties of the hardened material, since at this stage the template of the mature hardened microstructure is being set. WETSEM™ technology enables continuous viewing of the developing microstructures, and following of the morphology formation at this early stage, by making in-situ observations using a scanning electron microscope. In addition, qualitative elemental analysis can be performed with Energy Dispersive X-Ray Spectroscopy (EDS). The sequence of micrographs of Portland cement in Figure 1 was taken at 15 minutes, 3 hours and 24 hours after mixture preparation. The prepared mixture was inserted into a QX-202C capsule and imaged using a high vacuum SEM. An EDS spectrum of a Portland cement sample can be seen in Figure 2.

Figure 1

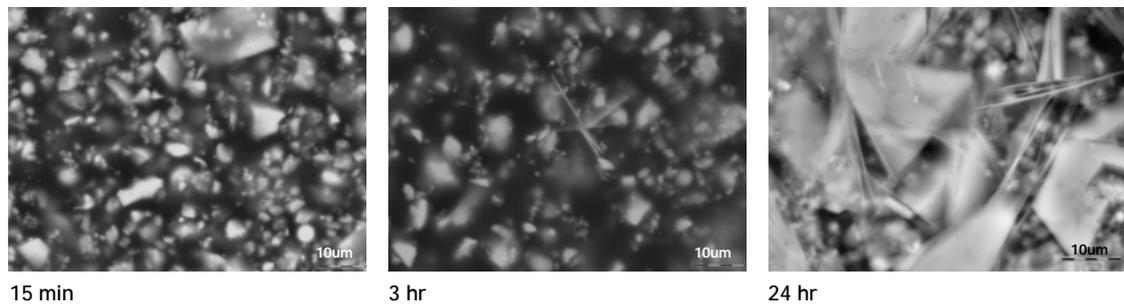
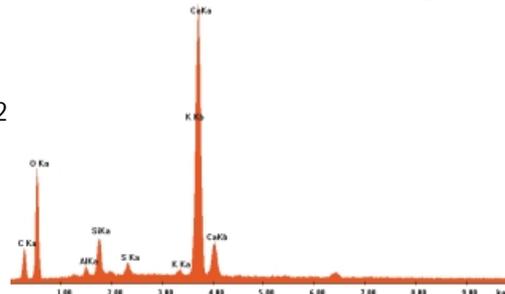


Figure 2



## Advantages of WETSEM™

- Enables in-situ observation of dynamic processes
- Can be applied in any SEM, high or low vacuum
- Sample is completely isolated from the microscope chamber
- Quick and easy to use with no sample preparation
- Samples imaged in fully wet conditions
- No need for drying, cooling, freezing or coating
- Allows elemental composition analysis by EDS