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Superabsorbent Water Absorption Process Observation by X-ray CT

About the sample: Superabsorbent

A superabsorbent polymer (SAP) is a polymer that can absorb extremely large amounts of a liquid relative to its own mass (about 300 times) and can retain it. So SAP is an ideal material used in products that are used to absorb and keep liquid such as a baby diaper. Sodium polyacrylate is one of the commonly used SAPs and is available in a granular form. The long polymer chains are coiled when it is dry. Then the chains uncoil when it absorbs liquid while the entire volume expands, and the liquid is stored in the spaces in the molecular network. Using X-ray CT ([computed tomography](#)), how liquid spreads into the SAP can be imaged even when the polymer is enclosed or packaged and the process is not visible from the outside.

Analysis procedure

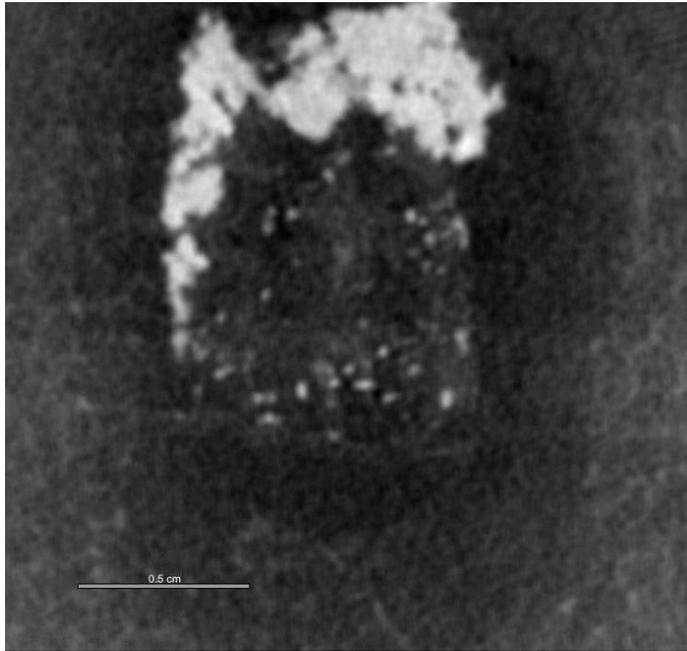
1. In this example, a small amount of SAP in contact with water was scanned using a high-speed-CT scanner, [CT Lab G X](#).
2. Using the resulting images, the water absorbed by SAP was segmented using the [thresholding](#) technique.
3. The change of the total volume of water absorbed SAP was calculated for a 120 seconds period.

1. CT scan

A small amount of SPA was taken from a baby diaper and put in a container and came in contact with water. The sample was placed in the [gantry geometry](#) CT scanner so that the water and SPA don't move during a fast scan. Four 18-second scans were collected over 120 seconds.

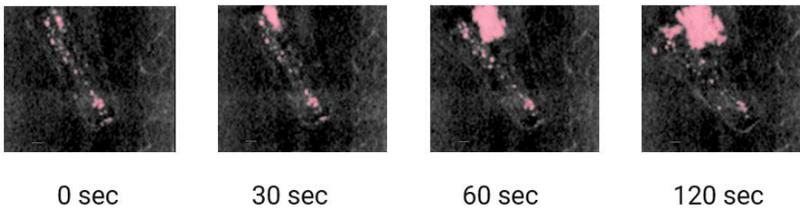


A CT cross-section collected 60 seconds after the water contact is shown. The gray level represents the density of the material. The SAP becomes dense as it absorbs water and the water-absorbed area appears bright in the CT cross sections.



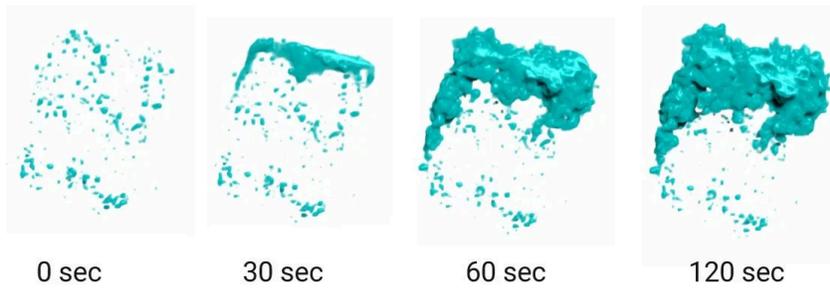
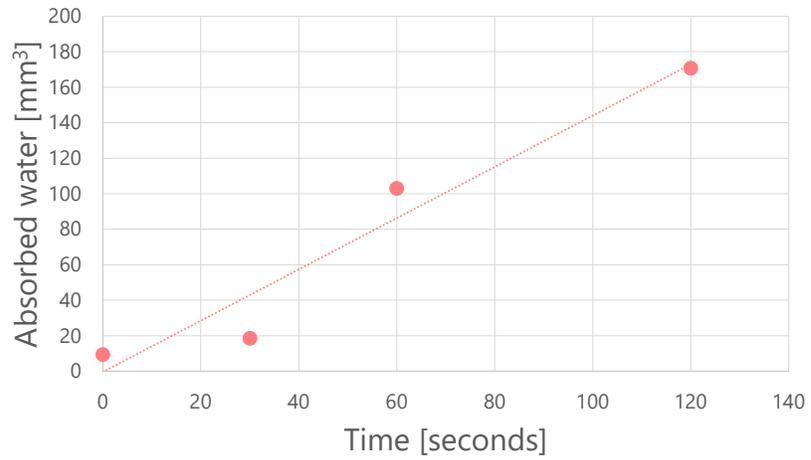
2. Segmentation

Using the resulting images, the water absorbed by SAP was segmented using the [thresholding](#) technique. The segmented region is colored pink. Cross-sections for 0, 30, 60, and 120 seconds after the water contact are shown.



3. Volume fraction analysis

The change of the water-absorbed area volume is plotted over 0 to 120 seconds. The 3D renderings of the water-absorbed area are also shown.



Related products



CT Lab GX

High-speed, stationary sample microtomography of medium-size samples