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Makeup Sponge Wear and Tear Analysis by X-ray CT

About the sample: Cosmetic blender sponge

A makeup sponge or cosmetic blender sponge is used to apply foundation and many other cosmetic products. They are foams usually made of latex or hydrophilic polyurethane. The price varies anywhere from 5 to 25 per piece. The more expensive ones are more hydrophilic and arguably work better although most manufacturers do not disclose what makes their products differ in terms of the materials or production methods. They also "age" after use and need to be replaced every couple of months. X-ray CT ([computed tomography](#)) can image these foam products non-destructively and reveal structural differences.

Analysis procedure

1. In this example, a piece of makeup sponge was scanned before and after 7-month of use using a submicron-resolution CT scanner, [nano3DX](#).
2. The foam structures were compared from CT cross-sections.
3. The porosities were calculated from segmented CT images.

1. CT scan

About a millimeter size piece was removed from a brand new cosmetic blender sponge and was scanned to produce the 3D grayscale CT image. The same experiment was repeated after the sponge was used and washed every day for seven months.

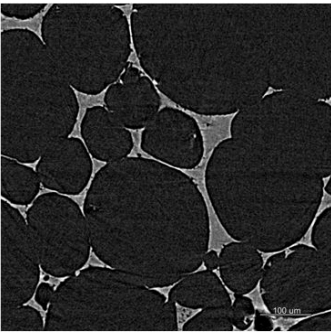


2. Image segmentation

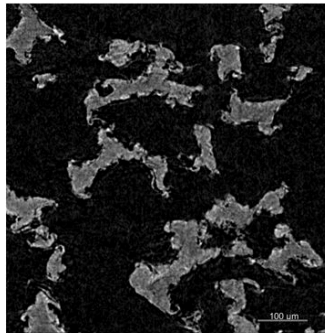
The gray level in CT images represents the density of the material. Light gray and dark gray represent the polymer and air, respectively. The brand new sponge shows intact round-shaped cells. Meanwhile, the one after 7-month of use appears crumbled and no longer holds round-shaped cells. The 7-month old sponge was less elastic and hydrophilic. This

structural change is consistent with these changes in performance.

Brand new



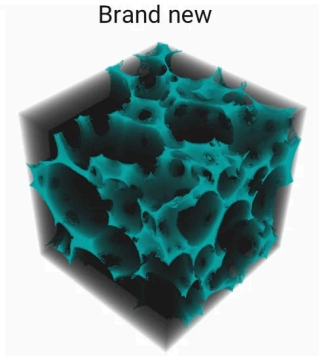
7-month old



3. Porosity analysis

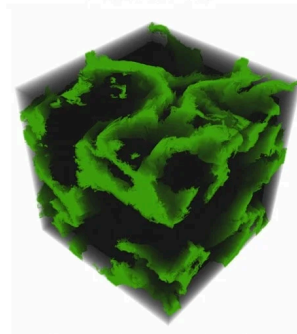
The polymer and air were segmented using the [machine learning segmentation](#) method. The wear and tear of the foam structure are clearly seen in the 3D rendered representation of the segmented area. The 7-month old sponge exhibited a significantly lower porosity of 84.4 vol% compared to that of the brand new sponge at 90.7 vol%.

Brand new



Porosity = 90.7 vol%

7-month old



Porosity = 84.4 vol%

Extra: Powder foundation sponge

This video shows an X-ray CT scan of a more traditional powder foundation sponge. The polymer part of the sponge is shown in pink. There is a powder foundation pressed on the surface of the sponge (blue). Where and how deep the powder is absorbed in the sponge can be observed in the cross-sections.

To learn more about micro-CT, read [What is micro-CT?](#)

Related products



nano3DX

Ultrahigh-resolution nanotomography using parallel beam geometry