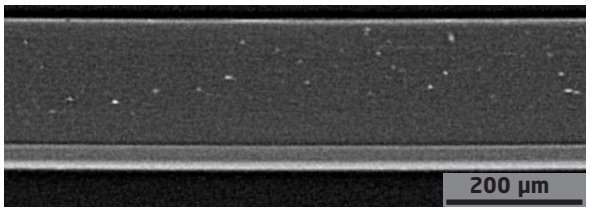
LINX 4life
Innovation Fund Denmark

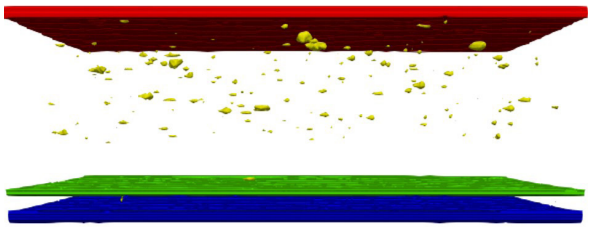
Non-destructive thickness determination of plastic layers

4life Solutions' mission is to change the lives of more than 2 billion people by providing access to clean drinking water. They do that by producing special plastic bags which are used to clean water when placed into sunlight. The water, contaminated with microorganisms, is therefore poured inside the bag and placed into direct sunlight. By the interaction of UV light and heat, 99.9 % of bacteria and viruses get killed such that the water can be consumed safely. The bags can be reused up to 500 times providing ca 2000 liters of clean water. However, in order to be used that often, the quality requirements on the used plastic foils are high. Therefore, 4life Solutions contacted the 3D Imaging Centre at DTU to perform X-ray micro Computed Tomography (CT) of the plastic foils from various providers to analyse the laminar composition of the foils and verify their quality.

4life Solutions' special plastic bag to be used for water cleaning.



2D slice of the foil obtained by X-ray micro CT showing the different layers, and cross sections of small "fibres" in the thick layer.



3D image of the extracted layers of the foil. While the top red and blue layer are almost of the same thickness, the green layer is the thinnest layer with 6 µm. The thickest layer is the one inbetween the green and the red one which also containes irregular shaped ellipsoids (yellow).

Challenge

The plastic foils consist of several layers, some of them supposedly strengthened by fibres. As 4life Solutions suspected that some of the foils did not live up to the specificactions from the vendors, the thickness of the layers and the appearance of the fibre-strengthened layers were set to be studied non-destructively.

Collaboration

Through the collaboration between 4life Solutions and the 3D Imaging Centre at DTU, the material was characterized using in-house micro X-ray CT and in-house developed analysis tools. This collaboration was part of the LINX project, in which researchers at leading Danish universities collaborate with scientists in industry to solve industry-relevant problems using advanced neutron and X-ray techniques. Besides projects for the members of the LINX association, the LINX project also supports outreach projects for companies which are not members of the LINX association. In this way, companies can test how they can benefit from X-ray- and neutron-based techniques.

Results

Three plastic foils from different providers were studied using a Zeiss Xradia 410 X-ray CT setup and a surface detection algorithm to extract the individual layers. One of the foils was expected to be composed of five layers of different thicknesses and is shown on the left. The analysis showed a ranging thicknesses from 6 µm (green layer) to 227 µm (layer in between green and red layer), while the full foil had a total thickness of 284 µm. The layer expected to be strengthened by fibres showed irregular ellipsoids rather than elongated fibres. The ellipsoids (yellow) were irregularly distributed, indicating the existence of an additional layer. With these findings, 4life Solutions was able to verfy which foils lived up to the vendors specifications, and to decide on a foil to used for their end product.

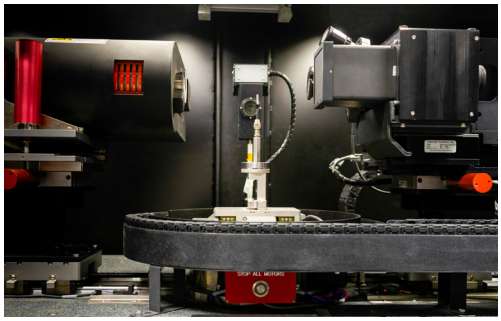
Perspectives

As the applied techniques can be used for various materials, also other companies might profit an image-guided decision processes due to collaboration with the 3D Imaging Centre at DTU.

Imaging Industry Portal

The Imaging Industry Portal is a part of the 3D Imaging Centre at DTU and assists companies in using and implementing 3D Imaging in research, development and production. The portal offers research-based 3D Imaging services and provides companies with the latest equipment and the most advanced knowledge within 3D Imaging and data analysis. The Imaging Industry Portal works as a gateway to ESS and MAX IV, as well as other large scale facilities.

www.imaging.dtu.dk/Industry-Portal



DTU 3D Imaging Centre