ASO kompakt
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Analytik Service Obernburg GmbH

No medical technology without materials science.

July 2007

Industries (A-Z)
Medical Technology

Objectives
Damage analysis
Material identification

Materials (A-Z)
Membranes
Tubes
Injection needle

Analytical Methods (A-Z)
Scanning Electron Microscopy (SEM-EDX)
IR spectroscopy
ESCA/XPS

Related Topics

Modern medical technology is based on a combination of materials science with medicine and pharmacy. Only this joint approach enables the development and the use of complex devices for medical applications. For that, the kidney dialysis is a good example. As shown in *Fig. 1*, the blood of a patient is led outside his body through a dialyser module and returned afterwards again. Inside the dialyser module, the toxic agents are filtered out through tiny pores without affecting essential blood constituents. Further components of a dialysis device include the blood pump, tube systems, and systems for measurement and monitoring. In addition, a medicament can be fed in that acts as an anticoagulant.

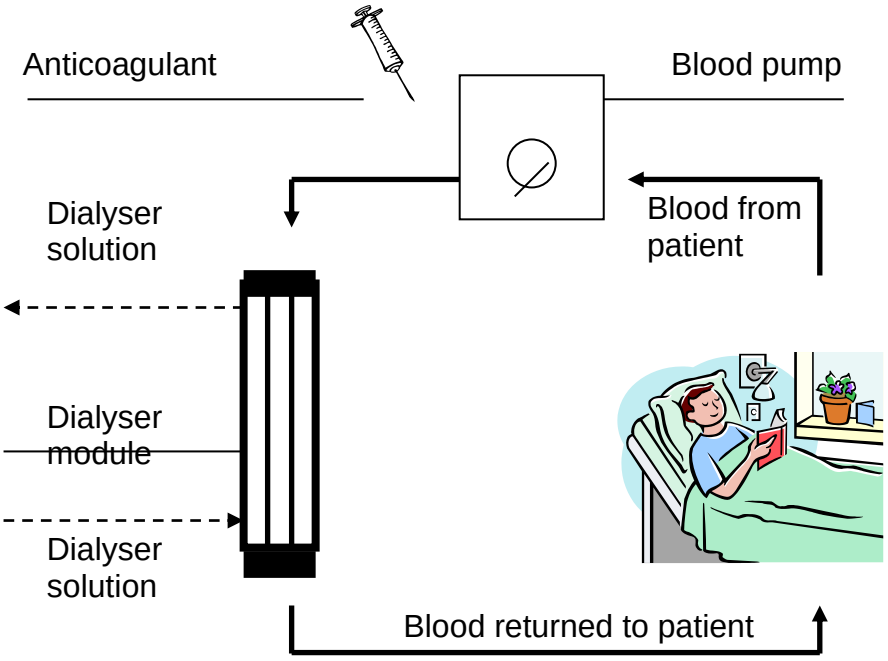


Fig. 1: Principle of the kidney dialysis.

The different components used here have to meet high requirements with regard to material and medical performance. From a materials point of view, important issues are for instance the identity verification and the characterization of the plastics applied or the failure analysis in case of malfunctions due to materials. For such tasks, the Analytik Service Obernburg has both years of experience and a broad portfolio of methods for physical and chemical analyses, respectively. Individual or combined problem-oriented microscopic, spectroscopic, mechanical or thermoanalytical investigations lead to a clarification of the particular problem - fast and at a reasonable price. Three typical examples are presented below.

Example 1: Faulty capillary membrane in the module of a dialyser device.

The filtration performance of purchased capillary membranes was complained about.

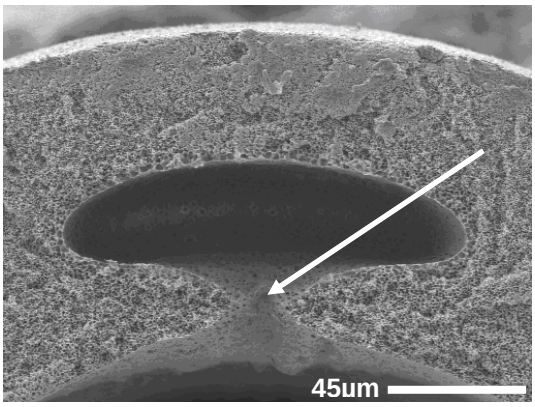
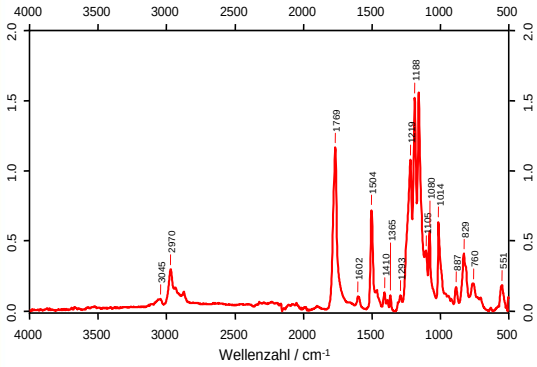


Fig. 2: SEM cross section of the failure zone of a capillary membrane.

In view of the small structures of the faulty hollow fibre membrane, its cross-section was analyzed by scanning electron microscopy (SEM), see *Fig. 2*. One sees large voids within the membrane wall. The detailed SEM-micrograph indicates that the voids are connected with the internal channel (lumen) of the capillary (arrow in *Fig. 2*). The large voids thus reduce the effective wall area down to one third of the specified value – and this is the reason of the malfunction observed.

Example 2: Identity verification of plastics.



Polymeric materials in components such as casings, membranes or tube systems are easily identified by infrared spectroscopy (FTIR). The signals in the FTIR-spectrum (*Fig. 3*) can precisely be assigned to the materials used. Therefore, FTIR is a powerful tool e.g. for failure analysis or assessment of customer complaints.

Fig. 3: FTIR spectrum of polycarbonate (PC), a material frequently used for transparent casing components.

FTIR in its microscopic mode is also made use of to identify tiny (from 15 µm in size) organic particles or deposits, for example in tube systems.

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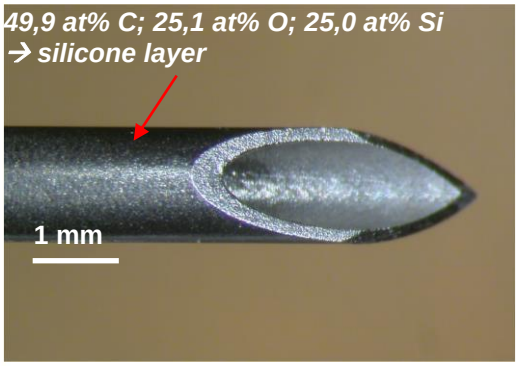
Example 3: Material surfaces in contact with biological media.



For material surfaces (canulas, membranes, tubes etc.) which are in direct contact with tissue or blood, the surface-sensitive analysis method ESCA/XPS (depth of information: some nm) is the first choice to investigate contaminations, coatings, or biocompatibility. An application example is shown in *Fig. 4*.

Fig. 4: Tip of a hollow canula and the elemental concentrations found by ESCA at the uppermost nanometers of the outside of the canula; a silicone layer is detected here.

Interested?
The Analytik Service Obernburg is ready to answer your questions and to help you.

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