Analytik Service Obernburg
Part of viridiusLAB AG

MEDICAL TECHNOLOGY

In medical technology, material science disciplines interact with medicine and pharmacy. Only through this combination is it possible to develop and use complex medical technology devices.

One example of this is artificial blood washing using hemodialysis. As shown in Fig. 1, a patient's blood is passed through a dialyzer outside the patient's body and then reintroduced. In the dialyzer, toxins are filtered out of the blood through small pores, while vital components remain in the blood. Other components of a dialysis machine include the blood pump, tubing systems and measuring and monitoring equipment. In addition, a drug that acts as an anticoagulant can be added to the dialysis machine.

The various components used here must meet high material and medical requirements. Important topics on the materials side are, for example, identity testing and characterization of the plastics used as well as the clarification of material-related damage. Analytik Service Obernburg has many years of expertise and a wide range of methods for physical and chemical testing. With problem-adapted microscopic, spectroscopic, mechanical or thermoanalytical tests - if necessary also in a suitable combination - the respective issue can be clarified quickly and cost-effectively. Three typical examples are presented below.

Industries
Medical technology

Analysis goals
Damage analysis
Material identification

Materials
Membranes
Tubes
Injection needle

Analysis method
Scanning electron microscopy (SEM-EDX)
IR spectroscopy
ESCA/XPS

EXAMPLE - FAULTY CAPILLARY MEMBRANE IN THE DIALYZER OF A DIALYSIS MACHINE

The filtration behavior of purchased capillary membranes was objected to. Due to the small structures of the defective hollow fiber membrane, it was examined in cross-section using scanning electron microscopy (SEM) (Fig. 2). Large cavities can be seen in the membrane wall. The detailed SEM image shows that the cavity is connected to the inner channel (lumen) of the capillary membrane (arrow in Fig. 2). The large cavities reduce the effective wall area of the capillary membrane to up to one third of the normal value and thus represent the reason for the observed functional reduction.

EXAMPLE - IDENTIFICATION TESTING OF PLASTIC MATERIALS

Infrared spectroscopy (FTIR) is used to identify the plastics used in device components such as plastic housings, membranes or hose systems. The signals in the FTIR spectrum (Fig. 3) can be precisely assigned to the materials used, which is very important when analyzing damage or processing complaints. The microscopic version of the FTIR analysis technique is also used to identify the smallest (from 15 µm in size) organic particles or deposits, e.g. in hose systems.

EXAMPLE - MATERIAL SURFACES IN CONTACT WITH BIOLOGICAL MEDIA

For material surfaces (cannulas, membranes, tubes, etc.) that come into contact with body tissue or blood, the surface-sensitive ESCA/XPS analysis method (information depth of a few nm) is the preferred method for investigating contamination, coatings or biocompatibility. An application example is shown in Fig. 4.

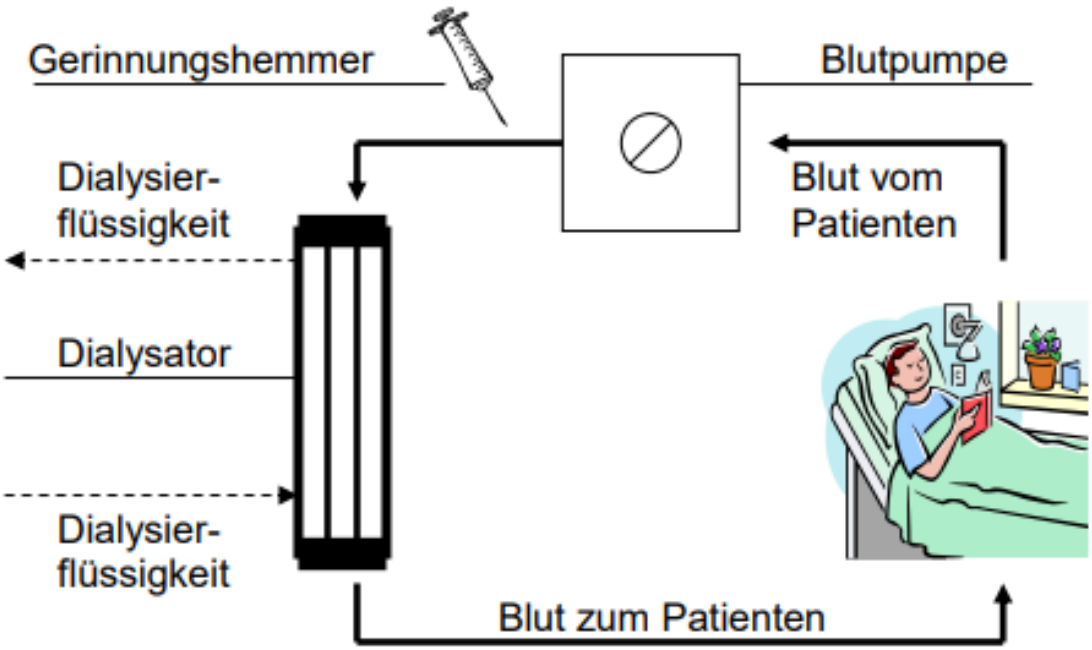

Fig. 1: Principle of artificial blood washing (hemodialysis)

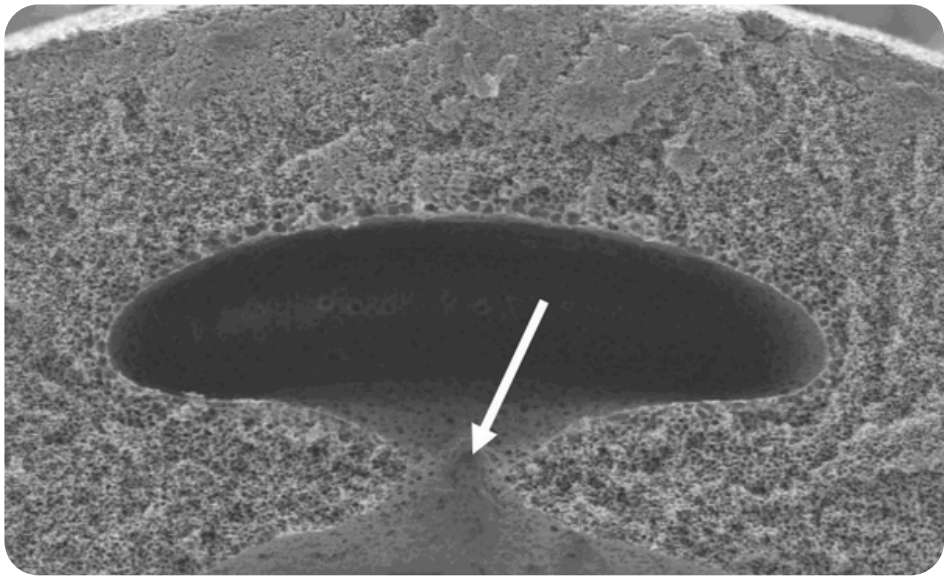

Fig. 2: SEM cross-sectional image of the damaged area

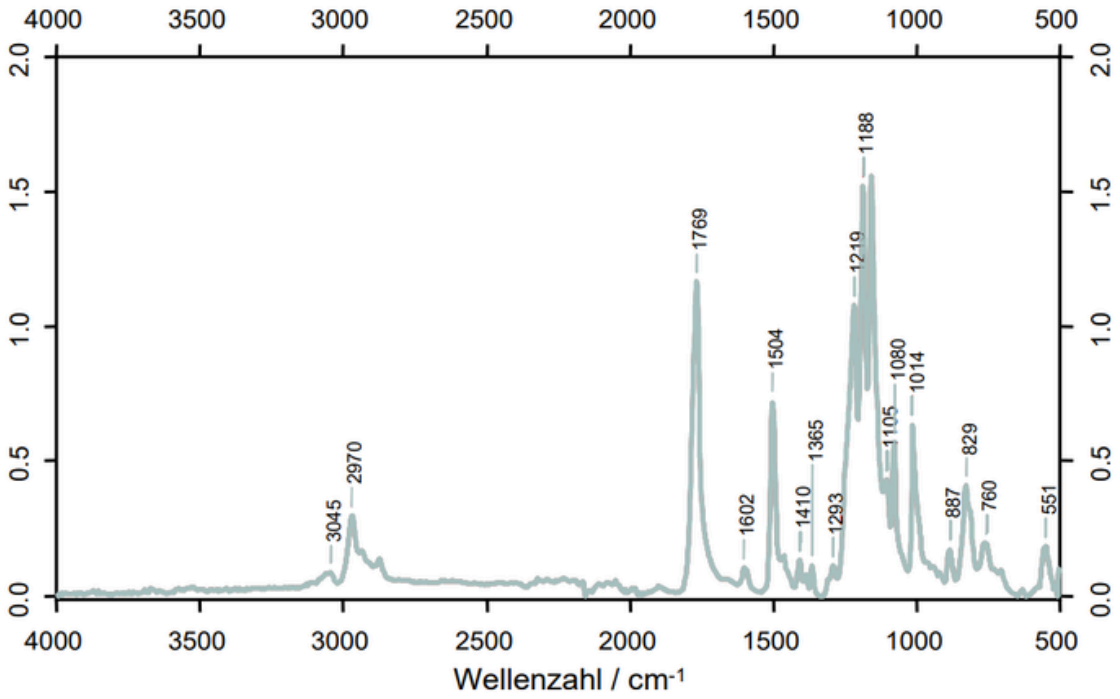

Fig. 3: FTIR spectrum of polycarbonate (PC), a material frequently used for transparent housing parts

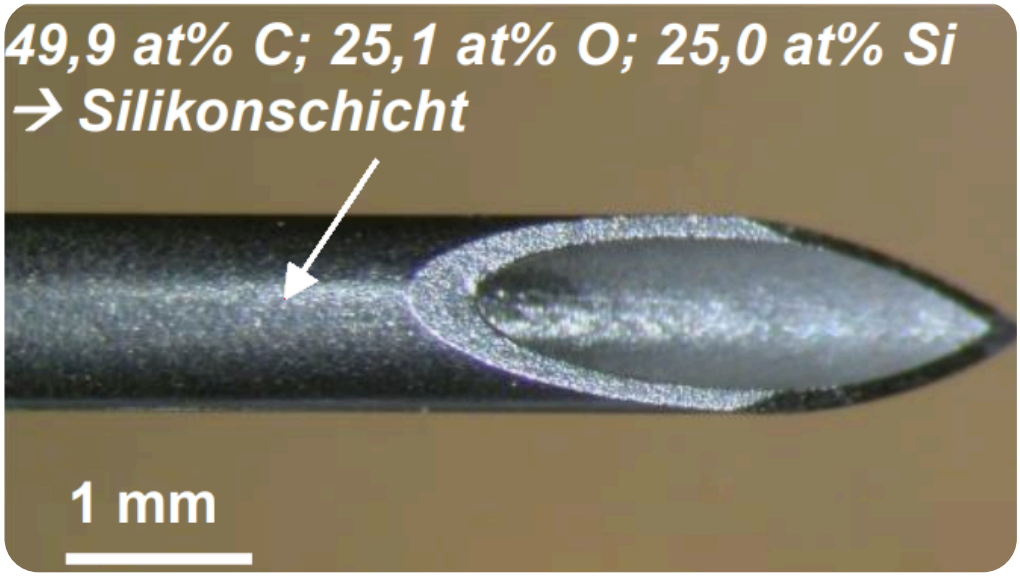

Fig. 4: Tip of a hollow cannula and the element concentrations found with ESCA in the uppermost nanometers of the outside of the cannula, which indicate a silicone layer