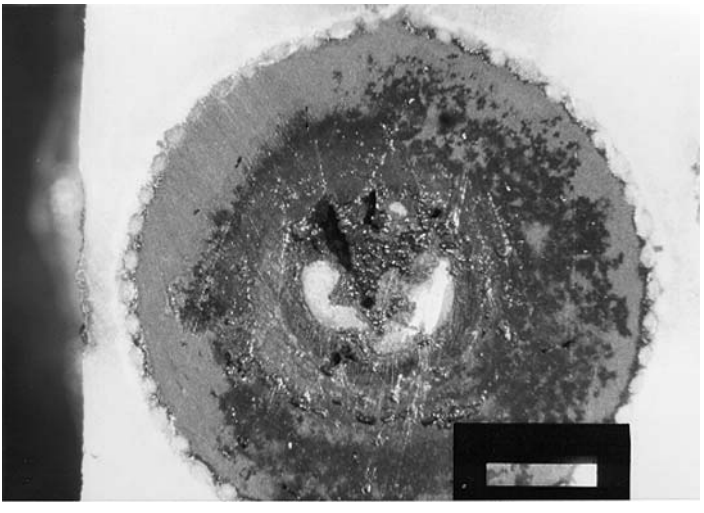

Figure 18.20 Cross-section through a tubular electrode of a battery after 3.5 years of operation. The lead rod (light-coloured area in the centre) has almost completely disintegrated as a result of corrosion. The diameter of the electrode is 8 mm. (Photo source: ZSW)

These large changes in volume act to loosen the active material. This effect increases with increasing depth of discharge. Thus, deep discharge with low currents has an additional negative effect on sulphation. Once the active material has become loose, it can be separated from the electrode, for example, by gas movement, and gathers as sludge at the base of the battery. If the volume below the electrodes that contains the sludge is not large enough, there is a danger of short circuits between the electrodes.

The erosion effect is much less pronounced in sealed batteries, as the electrodes there can be mounted under pressure. The pressure compensates the forces arising from the volume change and increases the stability of the active masses.

The available active mass at the electrodes is reduced by the loss due to erosion. This corresponds directly to a reduction in the accessible capacity. Accordingly, the battery will be discharged earlier.

18.4.7.4.5 Short circuits

In addition to the danger of short circuits in the sludge volume of batteries with liquid electrolytes, there are two further risks for short circuits.

The plate connectors from the positive electrode above the active material are also subject to corrosion. This results in detachment of large corrosion flakes, which can fall onto the electrodes and cause short circuits. This risk can be eliminated by including separators that extend upward well over the electrodes.

Further, there is a risk for all battery types that dendrites (microscopic short circuits) may grow from the positive to the negative electrode through the separators. These dendrites are so fine that they are usually not visible even when the battery is investigated