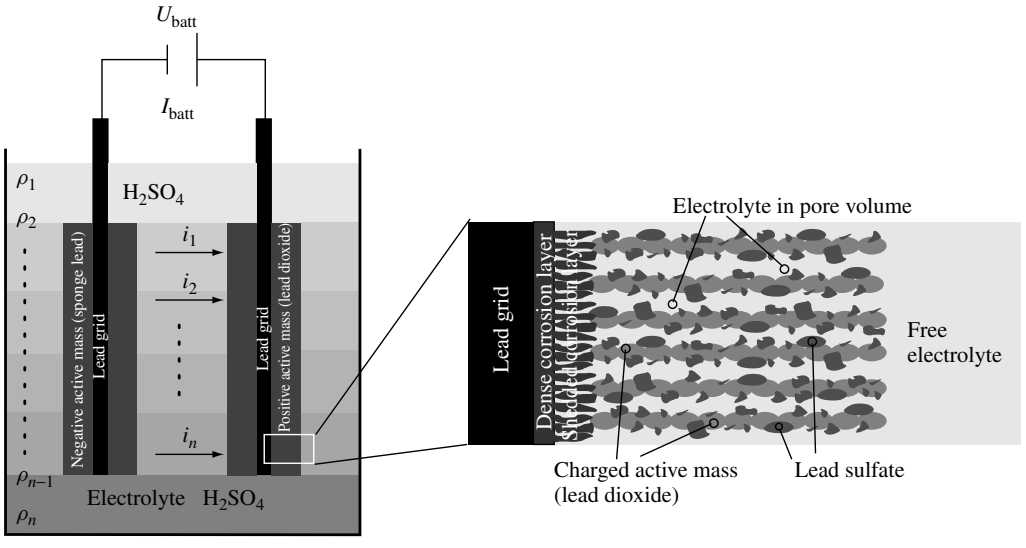

Figure 18.13 A more detailed schematic drawing of the lead acid battery. The left-hand side shows a macroscopic view of the cell including effects like acid stratification represented by the different electrolyte densities in different horizontal heights of the battery followed by inhomogeneous vertical-current distribution within the electrodes. The right-hand side shows a "microscopic" view of the active material in a partial state of charge

A separator is located between the electrodes, intended to prevent short circuits between the electrodes.

The above-described water electrolysis increases significantly as a function of voltage and temperature. As a rule of thumb, an increase in the so-called gassing rate by a factor of two is caused by an increase of 10 K in the temperature and by a factor of 3 by an increase in the cell voltage by 100 mV.

Regarding the hydrogen and the oxygen created as a result of the electrolysis reaction, two different technologies can be distinguished. In so-called flooded batteries, the electrolyte is in the liquid phase. To allow the gases to emerge from the battery, batteries with liquid electrolyte are not sealed gas tight. However, this results in a decrease in the water content of the battery and therefore the electrolyte level decreases and the concentration of the sulphuric acid increases. The water loss needs to be compensated during the maintenance that should take place once or twice a year. Deionised water must be used for refilling and not sulphuric acid or tap water.

The so-called valve-regulated lead acid (VRLA) batteries are sealed gas tight with a valve. The valve allows the release of gas only in the case of overpressure in the battery. In normal operation, the gas is recombined to water within the battery. This effect is achieved by an immobilisation of the electrolyte. Two different techniques are state of the art: the electrolyte is transferred into a viscous gel by adding SiO_2 to the electrolyte or the electrolyte is absorbed within a highly porous glass matt (absorbed glass matt type – AGM). In both cases, the oxygen can pass through the electrolyte to the negative electrode. The recombination of oxygen and hydrogen occurs