supply systems. They are by no means complete but should help to understand this chapter without additional literature. For more information, References [2, 3] are highly recommended.

18.2.3 Commonly Used Technical Terms and Definitions

A battery is made from two or more electrochemical *cells* connected in series. *Primary* and *secondary* electrochemical cells can be distinguished. Secondary batteries – also called accumulators – have reversible reactions and are rechargeable. This chapter is centred around them.

An electrochemical cell consists of two *electrodes*. Commonly, one is called the "positive" electrode and the other, the "negative" electrode. The positive electrode has a more positive potential than the negative electrode with respect to the standard hydrogen electrode.[7] Each combination of charged and discharged active material has a specific electrochemical potential. The potential difference between the positive and the negative electrode is called the *cell potential* or *cell voltage*. The *equilibrium voltage* of a cell is a function of the electrolyte concentration and the temperature. The *open-circuit voltage* can be measured if no external current flows through the battery. It is identical to the equilibrium voltage if all the internal overvoltages mainly caused by diffusion processes have levelled out. The time until this stadium has been reached depends on the battery technology and the operation condition. It is in the range of some seconds to many hours.

The *capacity* of a cell is measured typically in ampere-hours (Ah). The capacity is determined by a constant current discharge down to a defined *end-of-discharge voltage*. The capacity depends significantly on the discharge current and the temperature. Battery manufacturers can define the discharge current and the end-of-discharge voltage on their own. Therefore, it is very important to check the reference conditions defined by the manufacturer while comparing the capacity of different products.

Typically, nominal cell voltages are in the range between 1.2 and 3.6 V. Therefore, several cells are usually connected in series to build a *string* of higher nominal voltage. The *nominal voltage* of a battery is therefore defined by the number of cells connected in series times the nominal cell voltage of a single cell. Batteries are often sold in so-called blocks or modules. Therein, several cells have been integrated and connected in series with only one set of terminals. A well-known example is the starting, lighting, ignition (SLI) battery for cars where 6 cells are connected in series but are sold as one 12 V block. To increase the capacity of a cell, often several sets of positive and negative electrodes are connected in parallel within a single cell. To increase the capacity even more, two or more strings can be connected in parallel. The *nominal energy* content (Wh or kWh) of a battery is defined by the nominal battery voltage times the nominal battery ampere-hour capacity.

The *state of charge* (*SOC*) gives the capacity that can be discharged from a battery at a certain moment. Hundred percent state of charge means a fully charged battery, 0% SOC means that the nominal capacity is discharged. State of charge is defined in more

[7] The standard hydrogen electrode is a platinum electrode rinsed with hydrogen gas in 1 N electrolyte. Its potential is defined as 0 V.