18.4.7.6.1 Charging

As a result of the specific operating conditions, full charging occurs very rarely. Charge and discharge cycles follow each other very frequently. Long charging times at constant power supply as available in grid-connected systems do not occur. Nevertheless, field experience showed that full charging is necessary to achieve long battery lifetimes.

The most common charging strategy is the constant current/constant voltage mode (*IU* or cccv, Figure 18.23(a)). In autonomous power supply systems, this means that the battery is charged with the fully available power until the battery voltage reaches the defined end-of-charge voltage. From this moment, the charging power to the battery is limited in a way that this voltage limit is not exceeded (constant voltage mode). The voltage drops at the moment when the battery charging is not high enough (due to decreasing power generation or increasing load) to maintain the battery voltage at the given limit. Most charge regulators and battery chargers use this charging procedure.

A more advanced charging method is shown in Figure 18.23(b). The charging starts with a constant current/constant voltage charging, but the maximum voltage is reduced after a certain time to a lower limit (IU_0U). This allows higher voltages during the first constant–voltage phase, but avoids negative effects like gassing and corrosion due to long durations of the high voltage. Therefore, this charging method allows overall faster charging but avoids hazardous conditions in the battery. More and more sophisticated charge controllers in the market use this charging procedure.

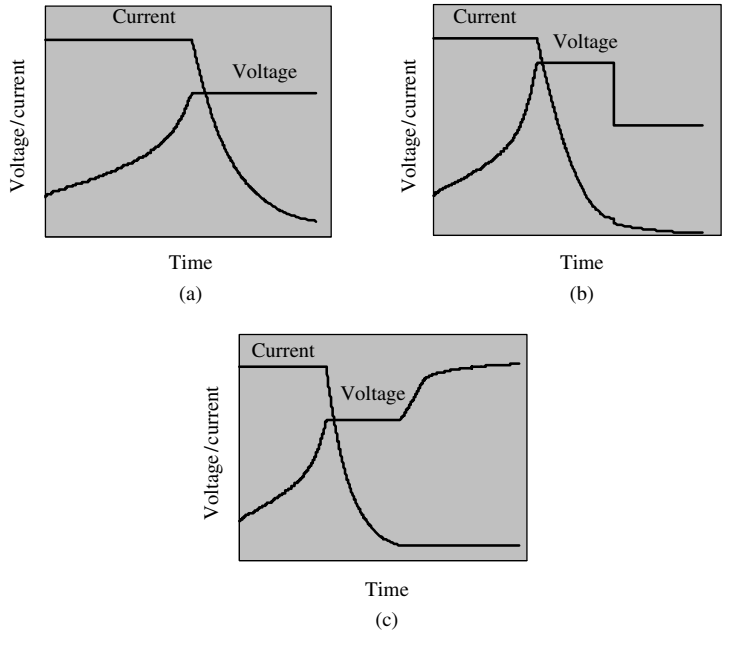

Figure 18.23 Schematics of different charge regimes. (a) Current and voltage during a constant current/constant voltage charge *IU* or cccv; (b) a constant current/constant voltage charge with two end-of-charge voltage limits IUU_0; and (c) a constant current/constant voltage charge followed by a limited constant current phase IUI_a are shown