

## Chapter 9

### Summary

In this book, after investigating the principal electrochemical theories concerning the electrodes and the measurement methods like cyclic voltammetry and impedance spectroscopy, the chemistry and the concept behind the water window was explained. It was also shown how charge balance is necessary to acquire a long electrode lifetime.

We saw how the electrode geometry affects the electrode stability and endurance and introduced methods to enhance lifetime through a better geometrical design. As it was further explained, in case of electrostimulation, signal waveforms must also lack high frequency components if longer operation durations are required.

In this study, beside using standard measurement devices like potentiostat, new hardware was designed and implemented in order to investigate microelectrodes. The electrode materials under investigation were iridium, iridium oxide and titanium nitride. It was shown that these can provide more charge injection capacity compared to the traditionally used platinum. Other alternatives like conducting polymers are also studied worldwide and may come to practical applications soon.

A new topic covered here is the effect of the counter electrode material on the faradaic reactions and galvanic corrosion in a two electrode monopolar stimulation system. It was explained how selecting a proper material for the counter electrode can enhance the electrode lifetime.

In the following last chapter, electrical models were extracted for the microelectrodes under investigation using impedance spectroscopy and current measurement while applying biphasic square voltages on the electrodes.