In this part of the book, the instrumentation and practical techniques needed for nanometre-scale materials characterisation and modification are discussed. This instrumentation has its roots in the tools developed in the 1930s and onwards for fundamental nuclear physics research. The requirement in nanoscience and technology for analysing or processing many different samples has led to a quite different evolutionary path compared to nuclear physics, where many measurements are made on a single specimen. In nanoscience and technology characterization and processing tools, on the other hand, are typically able to handle large numbers of samples and are often instrumented with other complementary surface analysis and processing techniques.

The first step is to produce high quality ion beams suitable for nanoscience research and technology. Different types of accelerators for both modification and analysis of nanostructures are presented in the first chapter. For applications where small beam spots are needed, the ion beam must be focused using magnetic lenses, which are discussed in the next chapter. Ion spectrometers and detectors are another key part of the instrumentation. These are used not only for materials characterisation, but also for end-point and diagnostic sensors for process control. The final chapter discusses readout and control electronics and the new possibilities afforded by modern approaches such as application specific integrated circuits (ASIC) and computer-controlled instrumentation.

Finally, the appendices collect key information about the SI units and a guide to selection of methods.