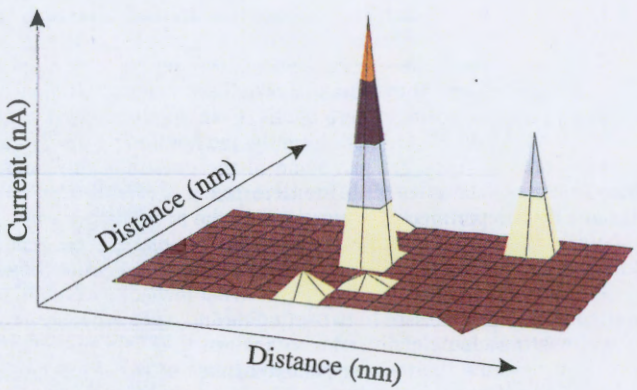
Electrochemistry at NUI Maynooth

Electrochemistry is a very diverse and fast-growing field of research of great importance to modern man. In the Department of Chemistry at NUIM, there are two research groups studying the fundamental electrochemistry of corrosion, on the one hand, and bioelectrochemistry and neurochemistry, on the other.

Corrosion is one of nature's greatest nanotechnologies. Corrosion cells consist of local anodic and cathodic regions, which act as small reactors, feed on the energy in the local environment, and have the capacity to grow suddenly and consume even a massive structure, for example an oil rig. An understanding of what happens, during the very early stages of the corrosion event, is crucial to the development of any corrosion protection system, the fabrication of protective coatings and the design of advanced materials. Therefore, much of the recent research in the Corrosion Science Laboratory at NUIM is concerned with the early detection of corrosion events, through the development of local probe techniques. This new scanning technology is being used in conjunction with bulk electrochemical techniques, such as electrochemical impedance spectroscopy, in studies on pitting corrosion, electrodeposition, conducting polymers, protective coatings and photoelectrochemical reactions.

Electrochemical sensors are (small) devices, capable of selectively measuring the concentrations of specific chemicals in different media. Much of the recent work in bioelectrochemistry has been directed towards the development of electrochemical sensors for environmental, industrial and medical applications. By far the most common such device is the enzyme-based blood-glucose biosensor used by diabetic patients in their daily treatment regime. Research in the Bioelectrochemistry Laboratory at NUIM focuses on the development, characterisation and application of sensors and biosensors in biomedical research.

The laboratory is divided into the Sensors Development Unit and the Neurochemistry Research Unit. The former focuses on the development and characterisation of micro-electrochemical sensors for real-time monitoring of important biological chemicals such as glucose, glutamate, oxygen and ascorbic acid (vitamin C). In the Neurochemistry Unit these sensors are used in fundamental physiological research, such as investigating the chemical mechanisms controlling the operation of the living brain.



Scanning probe image of local breakdown events on a surface.

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