Electrochemical redox cycling in small gaps for detection of biomarkers with high selectivity against background interferents

Andrew J. Gross\textsuperscript{a}, Sara E. C. Dale\textsuperscript{b} and Frank Marken\textsuperscript{a}
\textsuperscript{a}Department of Chemistry, University of Bath, Bath, BA2 7AY, UK
\textsuperscript{b}Department of Physics, University of Bath, Bath, BA2 7AY, UK
A.Gross@bath.ac.uk

Micro- and nano-gap electrode systems having two independently controlled working electrodes provide excellent opportunities in electroanalysis with applications ranging from mechanistic studies to single molecule detection \cite{1,2}. In this work a “generator-collector” technique is exploited in which one electrode (“the generator”) is used to convert a species of interest, which is then rapidly transported to the second electrode (“the collector”). This approach offers signal enhancement through current amplification, chemical filtration and spatial separation effects.

Dual-electrode systems prepared using straightforward methods are described and tested in aqueous solutions and biological media. Gold, indium tin oxide, and boron-doped diamond micro-gap electrodes were prepared using epoxy-based spacers partially etched using piranha solution. The electrodes have a plate-plate geometry with an inter-electrode spacing in the range 1 to 20 micron. Application of these electrodes in chemical sensing is demonstrated for model redox systems and biologically-relevant analytes in the presence of background interferents. The advantages and disadvantages of the micro-gaps will be discussed.

Figure 1: (A) Schematic drawing of the generator-collector sensing mechanism. (B) SEM micrograph of a microtrench electrode.
