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## Exploring electrode materials for microbially assisted electricity production by *Geobacter sulfurreducens*.

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For a few years it has been demonstrated that micro-organisms contained in different natural environments are able to form biofilms on electrode surfaces and oxidize the dissolved organic matter contained in the environment using the electrode as final electron acceptor [1,2]. The microbial electro-catalysis of anode oxidations has been used to design a lot of microbial fuel cells. A few microbially catalysed reductions have also been identified [3]. Different graphite and carbon anodes have been used, sometimes with surface modifications [4] and different morphologies [5].

The purpose of this work was to compare the efficiency of graphite, DSA® and stainless steel as anode materials and stainless steel and graphite as cathode materials for growing *Geobacter sulfurreducens* under imposed potential conditions. *Geobacter sulfurreducens* is a species that have been demonstrated to be able to catalyse either the electrochemical oxidation of acetate or the reduction of fumarate on graphite electrodes.

As for oxidation or reduction experiments, the current evolution showed a characteristic trend composed of an initial lag period followed by a sigmoid increase and a final stabilisation.

For oxidations, current densities obtained were seven times higher than values reported in literature [6] and strongly depended on the anode material. Surface analyses of the electrodes with optical interferometry, SEM and confocal microscopy, revealed significant differences in roughness and bacterial coverage, which could explain the variety of current densities obtained. For the cathodic part, optimizing cathode material increased the current densities from 0.85A/m<sup>2</sup> using graphite to 20A/m<sup>2</sup> with stainless steel, which was more than sixty times higher than results already published on growth of *G.sulfurreducens* with a graphite cathode. The variations in material roughness did not explain the differences on cathodic current densities. The nature of the electrode material was demonstrated to be a key factor in designing a microbial fuel cell, which could increase current densities by more than one order of magnitude.

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