

Nanoparticle decorated anodes for enhanced current generation in microbial electrochemical cells

Yanzhen Fan^a, Shoutao Xu^a, Rebecca Schaller^b, Jun Jiao^b, Frank Chaplen^a
and Hong Liu^a  

^a Department of Biological and Ecological Engineering, Oregon State University, 116 Gilmore Hall, Corvallis, OR 97331, USA

^b Departments of Physics and Electrical Engineering, Center for Electron Microscopy and Nanofabrication, Portland State University, Portland, OR 97201, USA

Received 30 July 2009;

revised 1 March 2010;

accepted 5 May 2010.

Available online 11 May 2010.

Abstract

The development of highly efficient anode materials is critical for enhancing the current output of microbial electrochemical cells. In this study, Au and Pd nanoparticle decorated graphite anodes were developed and evaluated in a newly designed multi-anode microbial electrolysis cell (MEC). The anodes decorated with Au nanoparticles produced current densities up to 20-fold higher than plain graphite anodes by *Shewanella oneidensis* MR-1, while those of Pd-decorated anodes with similar morphologies produced 50–150% higher than the control. Significant positive linear regression was obtained between the current density and the particle size (average Feret's diameter and average area), while the circularity of the particles showed negative correlation with current densities. On the contrary, no significant correlation was evident between the current density and the particle density based on area fraction and particle counts. These results demonstrated that nano-decoration can greatly enhance the performance of microbial anodes, while the chemical composition, size and shape of the nanoparticles determined the extent of the enhancement.

Keywords: Microbial fuel cell; Microbial electrolysis cell; Gold nanoparticle; Palladium nanoparticle; Electricity generation; Morphology

Source: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TFC-50297BX-2&_user=10&_coverDate=05%2F11%2F2010&_alid=1408246947&_rdoc=1&_fmt=high&_orig=search&_cdi=5223&_sort=r&_docanchor=&view=c&_ct=1&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=6a2fb1c56b0df19c34d256be977b93ff