Development of nanoporous gold electrodes for electrochemical applications

In this work we have used simple microfabrication techniques and chemical de-alloying of co-sputtered AgAu alloys to create nanoporous gold (np-Au) electrodes. The physical properties of the np-Au electrodes were investigated using scanning electron microscopy with energy dispersive X-ray analysis, X-ray photo-electron spectroscopy and profilometer. The electrochemical performance of the np-Au electrodes was measured by cyclic voltammetry and electrochemical impedance spectroscopy. We have fabricated np-Au electrodes with pore sizes between 10 nm and 60 nm, directly related to the Ag:Au ratio. The electrochemical results reveal that np-Au electrodes have much lower impedance than the conventional Au electrodes, due to the significantly higher surface area to volume ratio of np-Au. The np-Au electrodes made from Ag66Au34 and Ag60Au40 show more than 10-fold magnitude reduction in impedance compared to conventional Au electrodes. These results show that np-Au electrodes have a great potential for electrochemical applications.