

Enhancement of the catalytic activity of Fe phthalocyanine for the reduction of O₂ anchored to Au(111) via conjugated self-assembled monolayers of aromatic thiols as compared to Cu phthalocyanine

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We have prepared self-assembled monolayers (SAMs) of 4-aminothiophenol (4-ATP) and 1-(4-mercaptophenyl)-2,6-diphenyl-4-(4-pyridyl)pyridinium tetrafluoroborate (MDPP) functionalized with iron phthalocyanine (FePc) and copper phthalocyanine (CuPc) adsorbed on gold (111) electrodes. The catalytic activity of these SAMs/MPc was examined for the reduction of O₂ in aqueous solutions and compared to that of bare gold and with gold coated directly with preadsorbed MPc molecules. Scanning tunneling microscopy (STM) studies confirm the functionalization of the 4-ATP by MPc. STM images reveal that iron phthalocyanine molecules are chemically anchored to 4-aminothiophenol organic monolayers, probably having an "umbrella" type orientation with regards to the surface. The electrocatalytic studies carried out with Au/4-ATP/FePc and Au/MDPP/FePc electrodes show that the O₂ reduction takes place by the transfer of 4-electron to give water in contrast to a 2-electron transfer process observed for the