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Electrocatalytic production of hydrogen using iron sulfur cluster

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In response to the energy crisis, rising fossil fuel costs and global climate warming, this study focuses on the electrocatalytic reduction of proton into hydrogen using an iron sulfur cluster in the presence of pentafluorothiophenol. The direct reduction of pentafluorothiophenol at vitreous carbon electrode occurs at Ep -1.3 V vs. Ag/AgCl in $[Bu_4N][BF_4]$-DMF solution. Interestingly, in the presence of $[Fe_4S_4(SPh)_4][Bu_4N]_2$, the reduction potential shifts significantly to -0.98 V vs. Ag/AgCl. Based on gas chromatography analysis, the formation of H2 has been confirmed with a current efficiency of catalyst. 63% after two hours, while the chemical yield at the carbon electrode was about 46%. On the other hand, no H2 gas was detected without catalyst. Importantly, the increment of the concentration of acid (up to 18 equivalents) led to a positive shifting in the reduction potential until a value of 0.18 V. These results reflect the exquisite electrocatalytic efficiency of the protein-like iron sulfur cluster in Hydrogen Evolution Reaction (HER).

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