Division 6 Young Researcher Poster Award for the best poster in molecular electrochemistry

Jana Bulickova - *For poster No. S08-P-006*

"Nitrogen Fixation by Reduced Fullerene in the Cavity of Gamma-Cyclodextrin".

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Abstract:

Nitrogen Fixation by Reduced Fullerene in the Cavity of γ-Cyclodextrin

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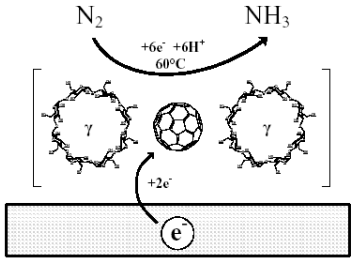
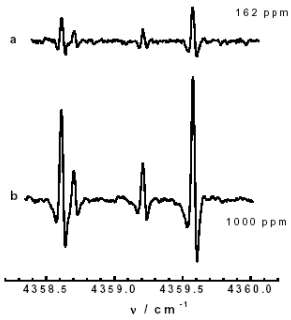
This communication reports on the electrochemical conversion of dinitrogen to ammonia at ambient pressure and 60°C mediated by reduced fullerene (C_{60}) inside a molecular cavity of γ-cyclodextrin (γ-CD) in aqueous solution.





Gaseous dinitrogen is a highly inert molecule, whose reduction to ammonia proceeds at ambient conditions in the nature under catalysis by the enzyme nitrogenase. The reduction of ammonia consumes six electrons and protons. The electrochemical nitrogen fixation in aqueous environment needs to overcome the energetic demands on the transfer of the first electron to the nitrogen molecule and at the same time the interfering hydrogen evolution, which decreases the concentration of available protons. Transfer of more than one electron is far less energetically demanding process and our cyclic voltammetric experiments show that the double reduced form of C_{60} of the [C_{60}-γCD_2] complex mediates the N_2 reduction to ammonia. This was confirmed also by the bulk electrolysis at -1.2V and 60°C. Electrogenerated ammonia was detected by photoacoustic and high-resolution iR spectroscopy. Figure on the left represents the photoacoustic signal from (a) electrolysed solution and (b) ammonia standard. Further studies confirmed that the reduction proceeds catalytically through the dissociation mechanism.

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