Anais

XXIV Simpósio Brasileiro de

ELETROQUÍMICA & ELETROANALÍTICA

Sociedade Brasileira de Eletroquímica e Eletroanalítica
SBEE

UNISINOS
DESAFIE O AMANHÃ.

PPGAD
Programa de Pós-Graduação em Ambiente e Desenvolvimento

UNIVATES

Simone Stülp
Tatiana Rocha
Leandro Machado de Carvalho
Daniel Ricardo Arsand
Daiane Dias
Pedro Hernandez Jr.
Fernanda Trombetta
Alexandre Schneider
(Orgs.)

Anais do XXIV Simpósio Brasileiro de Eletroquímica e Eletroanalítica

1ª edição

EDITORA
UNIVATES

Lajeado/RS, 2024

Universidade do Vale do Taquari - Univates
Reitora: Profa. Ma. Evania Schneider
Vice-Reitora e Pró-Reitora de Ensino: Profa. Dra. Fernanda Storck Pinheiro
Pró-Reitor de Pesquisa e Pós-Graduação: Prof. Dr. Carlos Cândido da Silva Cyrne

EDITORA
UNIVATES

Editora Univates
Coordenação: Prof. Dr. Carlos Cândido da Silva Cyrne
Editoração: Marlon Alceu Cristófoli

Avelino Talini, 171 – Bairro Universitário – Lajeado – RS, Brasil
Fone: (51) 3714-7024 / Fone: (51) 3714-7000, R.: 5984
editora@univates.br / http://www.univates.br/editora

S612 Simpósio Brasileiro de Eletroquímica e Eletroanalítica (24. : 2023 : Lajeado, RS)

Anais do XXIV Simpósio Brasileiro de Eletroquímica e Eletroanalítica, 2 a 5 de outubro de 2023, Lajeado, RS [recurso eletrônico] / Simone Stülp et al. (org.) – Lajeado : Editora Univates, 2023.

Disponível em: www.univates.br/editora-univates/publicacao/413
ISBN 978-85-8167-307-3

1. Eletroquímica. 2. Eletroanalítica. 3. Anais. I. Stülp, Simone. II. Rocha, Tatiane. III. Carvalho, Leandro Machado de. IV. Arsand, Daniel Ricardo. V. Dias, Daiane. VI. Hernandez Jr., Pedro. VII. Trombetta, Fernanda. VIII. Schneider, Alexandre. IX. Título.

CDU: 543.55

Catalogação na publicação (CIP) – Biblioteca Univates
Bibliotecária Gigliola Casagrande – CRB 10/2798

ISBN 978-85-8167-307-3

Nome dos autores: Alan M P Sakita, Edson A Ticianelli

Nome dos Apresentadores: Alan M P Sakita, Edson A Ticianelli, Alan M P Sakita

Instituição de Ensino: Instituto de Química de São Carlos, Universidade de São Paulo, Avenida Trabalhador Sancarlense, 400, 13566-590 São Carlos, São Paulo, Brazil

THE ROLE OF MICROENVIRONMENT ON THE ELECTROCATALYTIC ACTIVITY OF FE-N-C FOR CONVERSION OF CO2 TO SYNGAS

Resumo: The electrochemical conversion of CO_2 into value-added products, such as hydrocarbons or synthetic fuels, has garnered significant scientific interest. In this context, the exploration of novel electrocatalysts for CO_2 reduction plays a pivotal role in advancing such sustainable energy technology. Single-atom catalysts have demonstrated immense potential for efficiently reducing CO_2 to syngas, benefiting from both their high density of active sites and their intrinsic catalytic activity. This study focuses on investigating the influence of various parameters on the microenvironment of Fe-N-C catalysts during the CO_2 reduction reaction (CO2RR), in a membrane electrode assembly (MEA) electrolysis cell. Specifically, the impact of temperature, pressure, and catalyst surface modification with ionic liquid (IL) BMIM-PF_6 is evaluated. These variables allow for precise control of the local concentration of H^+ and CO_2 on the Fe-N-C catalysts, which are the main species governing the extent of CO production. Interestingly, contrary to the typical behavior observed for Ag and Ni-N-C catalysts, increasing the pressure up to 2.5 bar leads to a decrease in Faradaic Efficiency for CO production (FE_{CO}). Additionally, even slight increases in the current density (from 10 to 20 mA cm^{-2}) result in a four-fold enhancement in H2 production. On the contrary, an increase in the cell temperature remarkably enhances the FE_{CO}, which is considered atypical for many CO2RR catalysts. This observation suggests that additional thermal energy is required to facilitate the adsorption and desorption processes of CO_2 and CO, respectively. Furthermore, the incorporation of Fe-N-C with BMIM-PF_6, results in additional improvement in FE_{CO} as the back-pressure is increased up to 2.5 bar. This behavior suggests that BMIM-PF_6 serves not only as a co-catalyst but also functions as a CO_2 concentrator layer. In summary, results denote that the presence of ionic liquids (ILs) and the control of temperature are important factors for controlling the faradaic efficiency of CO_2 to CO conversion.

Agradecimento: We would like to acknowledge the following Brazilian research funding agencies for the financial support: grant, #2019/22183-6 and #2021/14163-5 São Paulo Research Foundation (FAPESP).