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IV Reunião Bienal da Sociedade Brasileira de Eletroquímica e Eletroanalítica

ARARAS-SP

ANAIS DA IV REUNIÃO BIENAL DA SOCIEDADE BRASILEIRA DE ELETROQUÍMICA E ELETROANALÍTICA

24 E 25 DE OUTUBRO DE 2024

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Green Hydrogen Production Assisted by Ethanol Electrooxidation in Alkaline Media using Ni-B Intermetallic Materials

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The generation of green hydrogen, that is hydrogen produced without carbon dioxide emissions, is one of the most significant tasks of the energy transformation. Electrochemical ethanol reforming in alkaline media can be considered as a viable method for green H_2 production in Brazil, based on a renewable and abundantly available feedstock, ethanol. Nonetheless, there is a need to develop effective and inexpensive HER catalysts for this process to be economically feasible. This work focuses on the preparation of Ni–B intermetallic catalysts for the HER since they are more affordable than the platinum-based catalysts. Nickel-boron (Ni-B) catalysts' physical properties were examined by X-ray diffraction (XRD) which displayed the formation of the Ni_3B phase when the sample was heated at 600ºC and 980ºC. The electrochemical measurements indicated that the catalytic activity for HER enhanced in the presence of ethanol, which supported the notion that ethanol electrooxidation enhanced the H_2 production. Also, to assess the stability of the Ni-B catalysts, the cyclic voltammetry test was performed and it was observed that the catalysts were quite stable for use in ethanol electrochemical reforming cells.

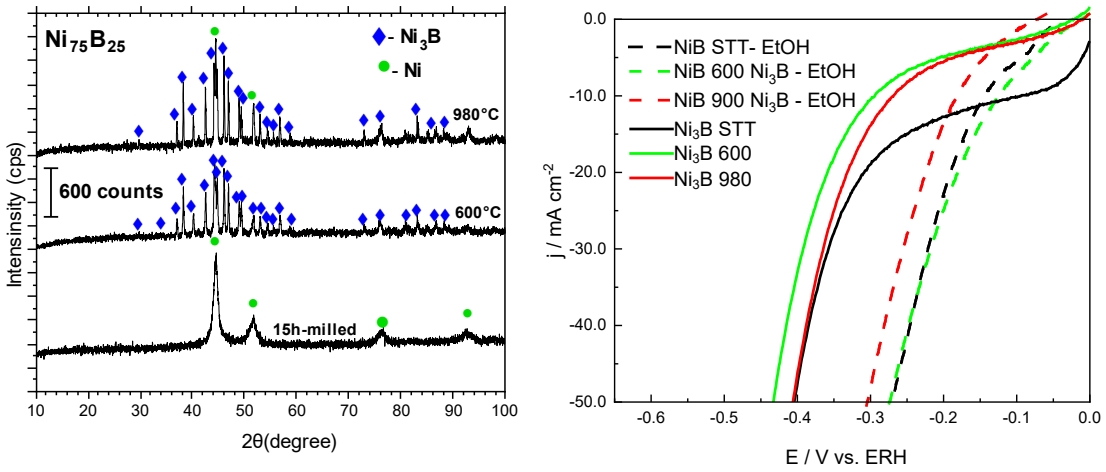

Figure 1: (a) XRD of Ni-B alloys at different temperatures, highlighting Ni_3B formation. (b) Polarization curves of catalysts in 4M KOH + 1M ethanol at 85°C.

Thus, the Ni-B intermetallic catalysts prepared in this work can be considered as promising for green hydrogen generation from ethanol in the basic environment. The findings of the study can therefore be useful in the creation of improved and sustainable H_2 production systems with a great implication on the Brazilian energy sector. The future work will be devoted to the further enhancement of the composition and porous structure of Ni-B catalysts for achieving higher activity and durability of the catalyst.

Acknowledgments:

This work was supported by FAPESP. Seiti Inoue Venturini also acknowledges CNPq for the scholarship (process number 383552/2023-0).