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Title: Bi-metallic boride electrocatalysts with enhanced activity for the oxygen evolution reaction

Author(s): Zhang, J (Zhang, Jian); Li, XX (Li, Xianxian); Liu, YT (Liu, Yiteng); Zeng, ZW (Zeng, Zhaowei); Cheng, X (Cheng, Xu); Wang, YD (Wang, Yadong); Tu, WM (Tu, Wenmao); Pan, M (Pan, Mu)

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Abstract: Rational design and understanding of the intrinsic mechanism are critical to develop highly active and durable electrocatalysts. In this study, a series of bi-metallic boride catalysts based on Ni and Co were prepared, and their activities were evaluated. The synthesised Co-10Ni-B catalyst exhibited excellent activity for water splitting in a 1 M KOH electrolyte. The overpotential was 330 mV at a current density of 10 mA cm(-2), better than previously reported mono-metallic borides and even IrO2. The synergistic effect of Co and Ni was proved by X-ray photoelectron spectroscopy and electrochemical impedance spectroscopy. The facile formation of critical intermediates CoOOH and NiOOH during the catalytic processes and a significant increase in surface area owing to the introduction of a second metal into mono-metallic boride were attributed to the superior catalytic performance of catalysts for the oxygen evolution reaction. A Co-10Ni-B-sp catalyst with a higher surface area than the Co-10Ni-B catalyst was also synthesised to evaluate the effect of a high surface area on the catalytic activity. A lower overpotential of 310 mV at a current density of 10 mA cm(-2) was achieved.

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Addresses: [Zhang, Jian; Li, Xianxian; Liu, Yiteng; Zeng, Zhaowei; Cheng, Xu; Wang, Yadong; Tu, Wenmao; Pan, Mu] Wuhan Univ Technol, State Key Lab Adv Technol Mat Synth & Proc, Wuhan 430070, Hubei, Peoples R China.
[Wang, Yadong; Tu, Wenmao; Pan, Mu] Wuhan Univ Technol, Key Lab Fuel Cell Technol Hubei Prov, Wuhan 430070, Hubei, Peoples R China.

Corresponding Address: Wang, YD; Tu, WM (corresponding author), Wuhan Univ Technol, State Key Lab Adv Technol Mat Synth & Proc, Wuhan 430070, Hubei, Peoples R China.
Wang, YD; Tu, WM (corresponding author), Wuhan Univ Technol, Key Lab Fuel Cell Technol Hubei Prov, Wuhan 430070, Hubei, Peoples R China.

E-mail Addresses: ywang@whut.edu.cn; tuwm@whut.edu.cn

Affiliations: Wuhan University of Technology; Wuhan University of Technology

Author Identifiers:

Author	Web of Science ResearcherID	ORCID Number
Wang, Yadong		0000-0002-2093-026X

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