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Journal of Materials Chemistry A Editor's choice collection: Advancing electrocatalysts for a sustainable world

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This Editor's choice collection has been curated by Dr Subrata Kundu, Associate Editor of *Journal of Materials Chemistry A*, with a focus on promoting sustainability in the quest to develop a robust electrocatalyst for the future.

Experimental findings in designing effective electrocatalysts has indeed formed attractive research in a very interesting area. Production of hydrogen from water electrolysis by means of electricity or combined photon energy application, electrosynthesis of various carbon-based value-added products and ammonia synthesis from nitrate or nitrogen reduction could help to mitigate the possible hazardous effects of greenhouse gases in the atmosphere.[1] The fruitful propagation of such electrochemical reactions involves designing suitable electrocatalysts with strategically modified electronic properties.[2,3] In order to showcase the developments of recent advanced electrocatalysts, this collection highlights the recent experimental and review papers published on this topic.

The reviews 'Plasmonic hot-electron assisted phase transformation in 2D-MoS_2 for the hydrogen evolution reaction: current status and future prospects' by Das *et al.* (**https://doi.org/10.1039/d1ta10918a**) and 'Recent advances in highly active nanostructured NiFe LDH catalyst for electrochemical water splitting' by Dhawale *et al.* (**https://doi.org/10.1039/d0ta10712c**) from India highlight the recent advancement of 2D materials used for hydrogen production *via* water splitting. Roy *et al.* from India reported the possible reasons for the activity enhancement and selectivity in sea water electrolysis (**https://doi.org/10.1039/d0ta08709b**). Amiri and Shahbazian-Yassar reported the recent advancement in high entropy materials for energy storage and conversion (**https://doi.org/10.1039/d0ta09578h**). Angnes and Gonçalves *et al.* portray the recent progress of highly porous MOF-derived materials for water splitting and energy storage applications (**https://doi.org/10.1039/d1ta05927k**). Another interesting report by Song *et al.* highlights the detailed journey of iron-based electrocatalysts for nitrogen reduction reaction (**https://doi.org/10.1039/d3ta01548c**). This present collection is not limited to these reports as there are several other reports that showcase the advancement of

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electrocatalysts in various other applications.

This collection also covers several other experimental findings from around the globe. Nagaiah *et al.* from India report the 'Self-powered NH_3 synthesis by trifunctional Co_2B-based high power density Zn–air batteries' (**https://doi.org/10.1039/d3ta02178e**). John *et al.* showcase the enhanced CO tolerance of the Ni^{3+}-rich Ni_2O_3 catalyst for urea oxidation reaction (**https://doi.org/10.1039/d1ta05753g**). Abdinejad and Burdyny *et al.* report the 'Immobilization strategies for porphyrin-based molecular catalysts for the electroreduction of CO_2' (**https://doi.org/10.1039/d2ta00876a**). Bedford *et al.* systematically investigated the 'Identification of catalytic activity descriptors for selective 5-hydroxymethyl furfural electrooxidation to 2,5-furandicarboxylic acid' (**https://doi.org/10.1039/d2ta08306j**). Liu, Gao and Chu *et al.* highlight the specific role of phase separated heterostructure materials for efficient hydrogen production *via* the methanol oxidation reaction (**https://doi.org/10.1039/d2ta02955c**). The report by Park *et al.* demonstrates the Co and Sn co-doped Ni_3S_2 over nickel foam for water oxidation reaction where they show a unique strategy to increase the activity by tailoring the electronic structure of doped and host metal ions (**https://doi.org/10.1039/d2ta09361h**). The work by Lee and Kim *et al.* features machine learning screening of transition metal single atom-based hydrogen evolution electrocatalysts that provides a fundamental understanding on the rational design of effective electrocatalysts (**https://doi.org/10.1039/d1ta09878k**). Mullins *et al.* report a Ni–S–P–O thin film over nickel foam with enhanced mass transport for water splitting applications (**https://doi.org/10.1039/d0ta12097a**). Kundu *et al.* provide a facile synthesis approach for $NiMoO_4$ nanomaterials under microwave heating over nickel foam for total water splitting applications (**https://doi.org/10.1039/d1ta02165f**). Apart from the various articles and reviews discussed, one important perspective article by Anantharaj and Noda where the 'significance of *iR* compensation in electrocatalysis' is re-visited, will certainly be helpful for the research communities working on similar topics (**https://doi.org/10.1039/D2TA01393B**).

These are just the few examples of important works recently published. There are several other important works included in this *Journal of Materials Chemistry A* collection which demonstrate the direct and indirect goals to produce low cost and robust electrocatalysts for a better and sustainable world.

References

1 J. O. M. Bockris, *Int. J. Hydrogen Energy*, 2002, **27**, 731–740.
2 Y. Shi and B. Zhang, *Chem. Soc. Rev.*, 2016, **45**, 1529–1541.
3 S. Anantharaj, S. R. Ede, K. Karthick, S. Sam Sankar, K. Sangeetha, P. E. Karthik and S. Kundu, *Energy Environ. Sci.*, 2018, **11**, 744–771.