Journal of Materials Chemistry A

ROYAL SOCIETY OF CHEMISTRY

EDITORIAL

View Article Online
View Journal | View Issue

Cite this: *J. Mater. Chem. A*, 2023, **11**, 22018

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

Subrata Kundu

DOI: 10.1039/d3ta90188b

rsc.li/materials-a

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

CSIR-Central Electrochemical Research Institute, India

Dr Subrata Kundu received his PhD from the Indian Institute of Technology (IIT), Kharagpur, India, in 2005. Then he moved to the University of Nebraska, Lincoln, USA, and later to Texas A&M University, College Station, Texas, USA, as a post-doc fellow (from 2005 to 2010). He is currently working as a principal scientist at CSIR-CECRI, Karaikudi, India. Kundu became a Fellow of the Royal Society of Chemistry in 2023. He has been an associate editor of the prestigious Journal of Materials Chemistry A and Materials Advances, Royal Society of Chemistry journals since 2022, and Nature's Scientific Reports since 2015. Kundu and his co-workers are working at the forefront of materials sciences with emphasis on the energy, environment, catalysis and electrocatalysis fields.

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.