

Next-Gen material paves way for efficient energy storage and green hydrogen

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Novel, easy to synthesize, highly efficient, polymeric materials could transform energy storage and production of clean fuel like hydrogen, facilitating accessibility of clean energy.

Zn(DAB) and Cd(DAB), are coordination polymers with smartly designed structures where zinc (Zn^{2+}) or cadmium (Cd^{2+}) metal ions and organic molecules of 3,3'-diaminobenzidine (DAB) naturally assemble to form layered frameworks with strong structures. They can be synthesized in large quantities through a simple, room-temperature process, without the need for complex equipment or high temperatures making them highly suitable for large scale usage.

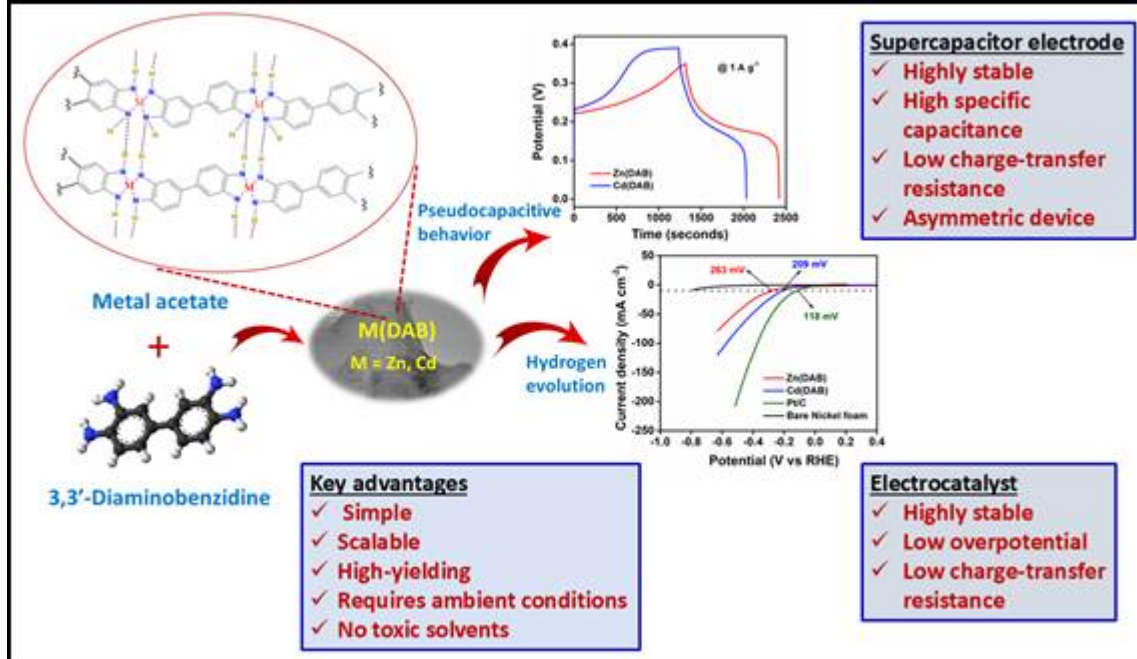
A team of scientists from Centre for Nano and Soft Matter Sciences (CeNS), an autonomous institute of Department of Science and Technology (DST), in collaboration with CHRIST (Deemed to be University), Bengaluru tested, Zn(DAB) and Cd(DAB) to find outstanding results in two of the most important areas of clean energy - storing energy and producing hydrogen.

In lab-scale tests, they were able to store a remarkable amount of energy, 2091.4 F g⁻¹ for Zn(DAB) and 1341.6 F g⁻¹ for Cd(DAB), in a standard three electrode setup used to evaluate materials individually. Even when tested in more practical, device-like conditions, typically asymmetric supercapacitors, they continued to perform impressively, with Zn(DAB) reaching 785.3 F g⁻¹ and Cd(DAB) achieving 428.5 F g⁻¹. The coordination polymers synthesised by the team also retained a significant amount of their energy capacity after 5000 continuous charge-discharge cycles, proving their durability.

These materials can also help produce clean hydrogen fuel by efficiently splitting water electrocatalytically. They required only a small amount of energy as overpotential; 263 mV for Zn(DAB) and 209 mV for Cd(DAB), which makes them highly competitive compared to some of the best materials known today. Hence, they could play a key role in making green hydrogen production more affordable and efficient in the future.

This dual-functionality viz., excellent energy storage and hydrogen generation makes Zn(DAB) and Cd(DAB), standout in the quest for cleaner energy solutions. As the world moves towards sustainable energy, innovations like this may hold the key to bridging the gap between research and real-world impact.

These findings, authored by Samika Anand, Abhishek Kumar, Dr. C. V. Yelamaggad, and Dr. Sunaja Devi K. R., were recently published in *ACS Omega* and *Catalysis Science and Technology*, highlighting the potential of coordination polymers as next-generation materials for clean energy.



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