पेटेंट कार्यालय
शासकीय जर्नल

OFFICIAL JOURNAL
OF
THE PATENT OFFICE

निर्गमन सं. 07/2026	शुक्रवार	दिनांक: 13/02/2026
ISSUE NO. 07/2026	FRIDAY	DATE: 13/02/2026

पेटेंट कार्यालय का एक प्रकाशन
PUBLICATION OF THE PATENT OFFICE

(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :28/12/2025
(21) Application No.202521132723 A
(43) Publication Date : 13/02/2026

(54) Title of the invention : BISMUTH-FUNCTIONALIZED 2D NANO-ELECTRONIC LAYERS FOR IMPROVED EV BATTERY STABILITY AND SAFETY

(51) International classification	:B82Y30/00, B82Y40/00, H01M10/04, H01M10/054, H01M10/0562, H01M10/585, C01G29/00, H01M4/64
(31) Priority Document No	:NA
(32) Priority Date	:NA
(33) Name of priority country	:NA
(86) International Application No Filing Date	: :01/01/1900
(87) International Publication No	: NA
(61) Patent of Addition to Application Number Filing Date	:NA :NA
(62) Divisional to Application Number Filing Date	:NA :NA

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(57) Abstract :
BISMUTH-FUNCTIONALIZED 2D NANO-ELECTRONIC LAYERS FOR IMPROVED EV BATTERY STABILITY AND SAFETY The present invention provides a development of the electric vehicle batteries encounter severe issues of stability and safety owing to dendrite formation, thermal runway, and decomposition of the electrolyte materials with high rates of cycling. This paper proposes bismuth-functionalized two-dimensional nano-electronic layers (Bi-2D NELs), which include bismuth oxide nanosheets with hybrids of graphene and MXene materials, and act as a multi-functional layer for Li metal electrodes. The addition of bismuth improves ionic conductivity (σ 10−2σ 10 −2 S/cm) and helps form a self-healing solid-electrolyte interface (SEI), which prevents more than 95% of dendrite formation after 1000 cycles of 5C rates. In-situ EIS results, along with DFT calculations, indicate that bismuth helps reduce Li^+ solvation energy and nucleation overpotential by 0.3 V. Thermal tests show that there is a 40% decrease in heating up, thus preventing runaway phenomena up to 200 °C. Full cells with NMC electrodes reach an 85% capacity retention ratio after 800 cycles, which is a 2.5x improvement over the control cells. Bi-2DN LEs provide a scalable means for the production of the next generation of EV batteries. FIG.1

No. of Pages : 13 No. of Claims : 2