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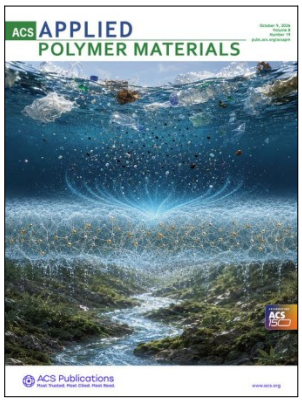
Journal Name: ACS Applied Polymer Materials **IF: 5.2**

Title: High-Performance Flexible Aluminum-Air Batteries Enabled by a PVA-HEC Gel Electrolyte

Author: Daksha D.; Padhan S.; Panigrahi H.; Doriya K.; Mishra S.

Details: Volume-8, Issue-19, 9th October, 2026

Abstract: Aluminum–air (Al–air) batteries are promising high-energy electrochemical storage systems, but the use of liquid alkaline electrolytes limits their practical implementation because of leakage, poor mechanical integrity, and electrolyte management issues. Herein, we develop a flexible three-dimensional dual-network gel polymer electrolyte (GPE) comprising poly(vinyl alcohol) (PVA), hydroxyethyl cellulose (HEC), and potassium hydroxide (KOH), in which the PVA–HEC composition and KOH concentration are systematically varied to regulate the porous network, mechanical properties, and ionic transport. The optimized G-2 formulation, containing equal amounts of PVA and HEC (2.5 g each) in 30 mL of 6 M KOH, forms a highly interconnected porous network with enhanced viscoelastic stability and electrolyte retention. The balanced PVA–HEC composition and higher KOH concentration result in an ionic conductivity of 0.26 S cm−1, substantially higher than that of the other investigated formulations (0.13 and 0.10 S cm−1), while also providing favorable interfacial charge-transfer characteristics. When integrated into a flexible Al–air cell with a Pt/C-coated Ni-foam air cathode, the G-2 electrolyte delivers a specific discharge capacity of 837.5 mA h g−1 and an energy density of 670 ± 4.56 Wh kg−1 at 3 mA cm−2. Furthermore, the cell maintains stable charge–discharge operation for 52 cycles under the applied cycling protocol. The combination of high ionic conductivity, mechanically robust gel structure, electrolyte retention, and flexible cell integration demonstrates a practical strategy for replacing leakage-prone liquid electrolytes in Al–air batteries. This work advances polymer-electrolyte-based Al–air systems by demonstrating that compositional control of a PVA–HEC dual-network can simultaneously address ionic transport and mechanical stability, providing a scalable platform for flexible and leakage-resistant energy-storage devices.



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Journal Name: Polymer Engineering and Science **IF: 3.6**

Title: Development of Activated Micronized Crumb Rubber by Physical Modification for Enhanced Usage in Tire Compound Formulations

Author: Poddar S.; Ganguly D.; Nair S.; Goswami L.; Bandyopadhyay A.

Details: 2026

Abstract: The limited compatibility of micronized rubber crumb (MRC) with virgin elastomers remains a major challenge for its large-scale use in tire compounds. In this study, we explored a facile physical activation method using solvent treatment to improve the surface characteristics and interfacial behavior of MRC in natural rubber (NR) and solution styrene–butadiene rubber (SSBR) matrices. The crumb was treated with toluene and acetone and dried under vacuum. The enhanced surface roughness generation was obtained particularly for the toluene-treated crumb, which was incorporated into rubber compounds at different loadings, by partially replacing N330 of the control recipe. The modified crumb lowered the tanδ at 60°C, implying better processability and reduced rolling resistance as compared to the control compound. Mechanical properties and hardness were largely retained, and aging resistance improved, especially in the SSBR-based compounds. In general, the results demonstrate that solvent-assisted physical modification provides a practical, scalable route to incorporate higher recycled rubber content into tire compounds without compromising essential properties.



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