Integration of Nano-Engineered Lightweight Composites for Electric Vehicle Battery Enclosures

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Abstract: *This study investigates the application of nano-engineered lightweight composite materials in electric vehicle (EV) battery enclosures to address thermal management, structural integrity, and environmental sustainability challenges. Building on advancements in polymer and metal matrix composites, and incorporating insights from EV drivetrain and battery thermal design, the research proposes a hybrid composite system reinforced with graphene and carbon nanotubes. This system is designed to reduce enclosure weight by up to 30%, enhance crash safety, and improve thermal conductivity for more efficient battery cooling. The methodology integrates finite element analysis (FEA), computational fluid dynamics (CFD) simulations, and experimental prototyping. The anticipated outcome is a composite enclosure that extends EV range, enhances safety, and aligns with circular economy principles through improved recyclability. Findings are expected to contribute to sustainable EV design, supporting the automotive industry's transition to low-carbon mobility.*

Keywords: electric vehicle