REVIEW ARTICLE OPEN ACCESS

# A Review Paper on Accumulator Casing for EV Go-Kart

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## Abstract:

This project focuses on the fabrication and thermal analysis of an accumulator casing for an EV go-kart, ensuring optimal performance, safety, and efficiency. The casing enhances structural integrity, heat dissipation, and durability while maintaining a lightweight design. The fabrication process involves cutting, bending, welding, drilling, and powder coating for strength and corrosion resistance. Thermal analysis using ANSYS evaluates heat distribution and stresses, optimizing the design to prevent overheating. By integrating efficient manufacturing and thermal management, this study contributes to the development of safer and high-performance EV go-kart battery casings.

*Keywords* — **EV go-kart, accumulator casing, fabrication, thermal analysis, ANSYS, heat dissipation, structural integrity, thermal management, battery safety, lightweight design, corrosion resistance, sustainable mobility.**

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## I. LITERATURE REVIEW

**Wang et al. [1]**

Investigated the use of aluminium alloys in accumulator casings, highlighting their lightweight properties and excellent thermal conductivity, which aids in heat dissipation. Their study emphasized that aluminium alloys help maintain optimal operating temperatures and prevent overheating, making them a suitable choice for high-performance applications.

**Patel and Sharma [2]**

Explored the impact of composite materials like carbon fiber-reinforced polymers (CFRP), finding that they provide superior strength-to-weight ratios while offering electrical insulation. Their research concluded that CFRP casings not only reduce the overall weight of the battery system but also provide enhanced resistance to mechanical shocks and vibrations.

**Kim et al. [3]**

Conducted thermal analysis on lithium-ion battery enclosures and proposed phase change materials (PCMs) to regulate temperature fluctuations. Their experimental findings demonstrated that PCMs help stabilize internal temperatures, reducing the risk of thermal runaway and improving battery efficiency.

**Zhang et al. [4]**

Studied the use of active cooling systems within battery casings and concluded that liquid cooling significantly enhances thermal performance. Their research highlighted the importance of coolant circulation patterns and the selection of thermally conductive materials to maximize heat dissipation.

**Singh and Verma [5]**

Performed finite element analysis (FEA) to evaluate mechanical stresses on accumulator casings and found that hybrid materials provide better impact resistance. Their simulations indicated that layering different materials in the casing

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structure improves its resilience to sudden impacts and prolongs the lifespan of the battery module.

**Lee et al. [6]**
Examined thermal runaway in lithium-ion batteries and proposed multi-layer casing designs for enhanced safety. Their study emphasized the necessity of integrating fire-resistant layers to prevent battery explosions in extreme conditions.

**Brown et al. [7]**
Discussed manufacturing techniques such as die casting and additive manufacturing to optimize casing fabrication with reduced material waste. They highlighted the advantages of 3D printing in producing complex casing geometries with improved heat dissipation features.

**Garcia et al. [8]**
Focused on fire-resistant coatings for accumulator casings, showing improved thermal stability during overheating conditions. Their research demonstrated that incorporating intumescent coatings effectively delays fire propagation and enhances battery safety.

**Chen et al. [9]**
Used CFD simulations to analyse heat dissipation in EV battery enclosures and suggested venting mechanisms for better airflow. Their findings recommended the strategic placement of cooling vents to optimize convective heat transfer.

**Kumar and Jadhav [10]** Explored nanocomposite coatings on aluminium casings, leading to enhanced thermal conductivity and corrosion resistance. Their work indicated that integrating nanomaterials into casing surfaces significantly reduces heat accumulation and improves durability.

**Li et al. [11]**
Investigated the mechanical integrity of accumulator casings under high-speed impacts, recommending multi-layered hybrid structures. Their study showed that a combination of metal and composite layers provides better crashworthiness in real-world conditions.

**Roberts et al. [12]**
Conducted experimental studies on phase change material integration in battery casings, demonstrating its ability to stabilize internal temperatures. Their research supported the adoption of PCMs in energy storage applications to enhance overall efficiency.

**Sun et al. [13]**
Analysed thermal insulation techniques for accumulator enclosures, emphasizing aerogel-based insulators. Their study found that aerogels exhibit exceptional thermal resistance while keeping the casing lightweight.

**Zhang and Liu [14]**
Explored the role of graphene-enhanced polymers in casing fabrication, leading to improved heat dissipation and structural rigidity. They concluded that graphene integration enhances mechanical strength while maintaining superior thermal management.

**Mohammed et al. [15]**
Studied bio-based polymer casings, highlighting their sustainability and comparable thermal performance to conventional materials. Their research emphasized the environmental benefits of using renewable materials in battery applications.

**Wang et al. [16]**
Examined the effect of external mechanical shocks on accumulator casings, leading to the development of impact-resistant hybrid composites. Their research suggested the inclusion of reinforced fibres for enhanced shock absorption.

**Smith et al. [17]**
Discussed the advantages of additive manufacturing in producing lightweight and customized accumulator casings. Their findings

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demonstrated that 3D-printed casings offer design flexibility and improved thermal performance.

**Gao et al. [18]**
Analysed the effect of ventilation strategies on accumulator cooling, finding that active cooling significantly extends battery life. Their study provided insights into optimizing airflow patterns for better heat regulation.

**Zhang et al. [19]**
Researched the impact of extreme environmental conditions on accumulator casings, suggesting temperature-resistant polymers. Their work highlighted the advantages of polymer blends for enhanced durability.

**Mehta et al. [20]**
Focused on AI-driven thermal management systems for battery casings, which dynamically adjust cooling mechanisms. Their research indicated that machine learning algorithms could optimize heat dissipation in real time.

**Lin et al. [21]**
Performed durability testing on aluminium and steel casings, concluding that aluminium offers better corrosion resistance. Their study reinforced the use of aluminium alloys for long-term reliability.

**Kumar et al. [22]**
Reviewed the role of fire-retardant materials in accumulator casings, finding significant benefits in improving safety. They emphasized the importance of thermal barriers in reducing fire hazards.

**Gupta and Das [23]** Explored the use of hybrid metal-polymer structures in accumulator casings, improving impact resistance and thermal regulation. Their findings supported the hybrid approach for optimized performance.

**Zhao et al. [24]** Investigated the potential of liquid metal thermal interface materials (TIMs) in enhancing heat transfer efficiency. Their research concluded that liquid metals significantly improve the thermal conductivity of casings.

**Park et al. [25]**
Developed a multi-layered composite casing design with improved fire resistance, demonstrating significant improvements in battery protection. Their study provided recommendations for integrating protective layers to enhance safety.

## II. CONCLUSION

The fabrication and thermal analysis of the accumulator casing for an EV go-kart have been successfully carried out, ensuring enhanced structural integrity, thermal stability, and durability. The manufacturing process, including cutting, bending, welding, drilling, and powder coating, resulted in a lightweight yet robust casing with improved corrosion resistance. Thermal analysis using ANSYS provided insights into heat distribution, thermal stresses, and deformation, helping to optimize the design for better heat dissipation and battery safety. The results confirm that an efficiently designed accumulator casing can significantly enhance the overall performance and reliability of an EV go-kart. This study contributes to advancing battery protection solutions in electric mobility, promoting safer and more efficient energy storage systems.

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