HOW ALUMINIUM IS HELPING TO DECARBONISE THE TRANSPORT SECTOR AND PROMOTE A SUSTAINABLE FUTURE

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Aluminium is a universally versatile metal, after steel. Therefore, it is widely used across various sectors. The automotive industry is a particularly large consumer of the material, currently using approximately 19% of all aluminium consumed worldwide. Demand is expected to double in next 30 years due to the surging sales of Electric Vehicles (EV), from 2 million in 2018 to 12 million in 2025.

Why aluminium is the metal of choice

Aluminium is the metal of choice for EVs because of its proven track record in Internal Combustion Engine (ICE) cars, with its ability to reduce the weight of vehicles whilst enhancing performance, safety, fuel efficiency and durability making it a particularly effective choice. These factors also mean that the material contributes extremely positively to national and international efforts to minimise the levels of carbon emitted by road vehicles.

The price of aluminium is typically about three times higher than of steel, but the automotive industry is prepared to accept the price difference as it needs to compensate for the weight of batteries (400 to 800 kg) and therefore prioritise materials that enable effective light-weighting to ensure sufficient distances can be achieved between charges.

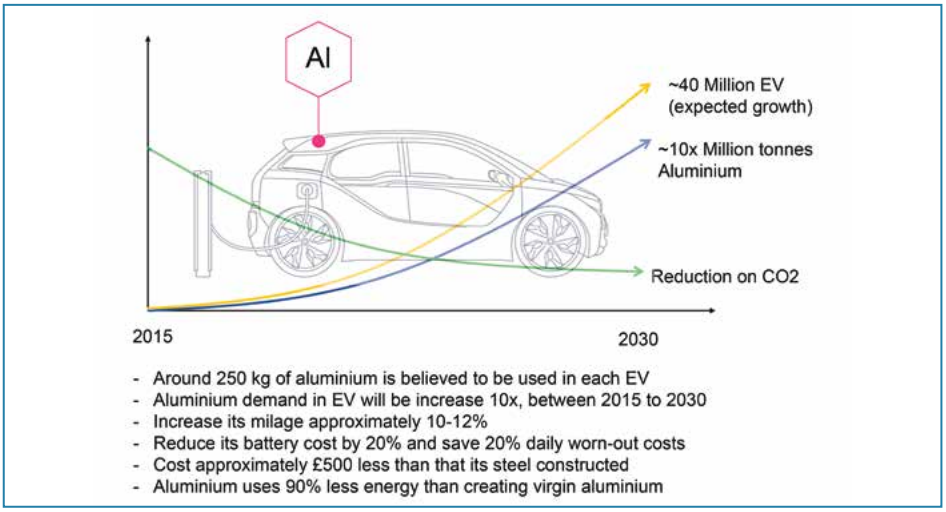
It is estimated that, for every 100 kg weight saving, an EV can increase its milage by approximately 10-12%, reduce battery costs by 20% and save 20% daily worn-out costs.

Keeping electric and hybrid vehicles cool and light

Studies have found that aluminium intensive vehicles can cost approximately £500 less than vehicles constructed using steel, given an equal range target. By using lightweight cast extruded and rolled structural components with aluminium thermal management and aluminium cables, it is possible to make electric and hybrid cars stay cool and light.

Additional key advantage of using aluminium is its complete and infinite recyclable characteristics. Aluminium uses 90% less energy than creating virgin aluminium and could reduce CO_2 emissions by up to 26%. It is also usually 20-30% cheaper with no loss of properties.

Most recent automotive trends show that alloy selection is moving towards 6xxx alloys from 5xxx mainly because of the higher strength and formability that can be achieved. At the same time, there is an enormous challenge to weld and form 6xxx due to hot-cracking susceptibility through conventional welding technology. This limitation can be overcome through a better understanding of alloy constituents and exploring innovative new technologies. Above all, it is essential to put complete recycling management at the forefront of decision making when it comes to selecting materials to use. For example, embedding circular product design principles and supporting a circular business model where all materials can be used to their full potential to drive down the level of CO2 emitted throughout the vehicle manufacturing process.



Research and development at WMG, University of Warwick

At WMG, University of Warwick, we work on this multifaceted problem by integrating material science, processing, and advantageous tools like Machine Learning (ML), Artificial Intelligence (AI) and supply chain management into our research and development activities. In terms of Al-alloys, our research focuses on adopting fundamental and applied research to engineer microstructures, which are suitable for transport applications. This includes careful consideration around material recycling with a view to increasing residual tolerance such as Fe on Al.

Our research on forming focuses on improving material formability through hot-forming and quenching. In terms of welding and joining, we are using Self-Piercing Riveting (SPR), ultrasonic welding and Remote Laser Welding (RLW) for Body in White (BIW) structures and battery construction.

Our recent research focus is to use ML and AI to separate scrap metals and improve waste management processes. WMG's material testing facilities are capable of testing material from the coupon to component level. Alongside this, our characterisation facility is capable of analysing materials in nanometre (nm) detail by using advanced microscopes.

Find out more about WMG's Materials and Manufacturing research here: https://warwick.ac.uk/fac/sci/wmg/research/materials/