New product vision for Aerospace by applying of lightweight Al-Li based alloys and Al-Mg-Sc material technologies

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The criteria for material selection for aerospace application have evolved over the years. In this century the key characteristics of successful aerospace products are driven by customer value and minimal environmental impact. In the neck-and-neck race from aluminium alloys and polymer based composite seems there is a big chance for aluminium based material to take over the leading position in the future aerospace products again. The statement is an introduction of new design concepts with appropriate alloys and material technology, that supports the new approach of "care free" structure designed for minimum life cycle cost. Today a combination of low weight, good damage tolerance, reliability, maintainability, low manufacturing cost, recyclability are needed to satisfy the required operating cost and safety of the aircraft. A reduction in weight together with improving resistance to corrosion decisively influence the direct operating costs of fixed-route services for airlines and hence the cost effectiveness. Under pressure from competing CFRP (Carbon Fiber Reinforced Plastic) for structural application Al-Li based alloys and Al-Mg-Sc technologies are a new trust for the aluminium industry. A revolutionary utilization of aluminium-based technologies paves the design of lighter, greener aircrafts by ensuring the highest level of reliability.

The most attractive reason for Lithium alloying is the beneficial impact on stiffness and weight reduction. Every addition of 1 wt.-% Li decreases the density by roughly 3% and increases the elastic Young's modulus by 6%. By adding scandium to the alloy systems Al-Mg, Al-Mg-Li and Al-Cu-Li increases in strength amounting to 20-50 MPa per 0.1 wt.-% Sc can be achieved. The low density, high modulus, improved material properties especially damage tolerance, weldability and good corrosion properties are the main objectives for introducing them in future aerospace products. The new materials are designed for competitive lightweight products to issue a guarantee for improvement concerning performance, cost reduction, extend service life and reduced environmental impact.

The current and planed facilities of casting houses in France and Germany are opening new page in the aerospace industry for application of existing low density alloys in aerospace. Thus it also offers the chance of developing further advanced lower density alloys under the consideration of recycling issues. Furthermore, the "European opportunity" of scrap recycling created during the manufacturing is an added value to the overall supply chain. The key criteria for successful material development based on the patent portfolio from EADS Innovation Works regarding the success story on Al-Mg-Sc and Al-Li alloys technology for aerospace application have to be presented here.