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Project title:	**MMCCast** – Development of the sizing system and the textile semi-finished product for the production of fibre-reinforced aluminum composites
Partner:	▪ Samkee Automotive Co. Ltd, Seosan-si, South Korea ▪ Shinhan Precision, Yangsan, South Korea ▪ FibreCoat GmbH, Aachen, Germany ▪ EMIL OTTO Flux- und Oberflächentechnik GmbH, Eltville, Germany
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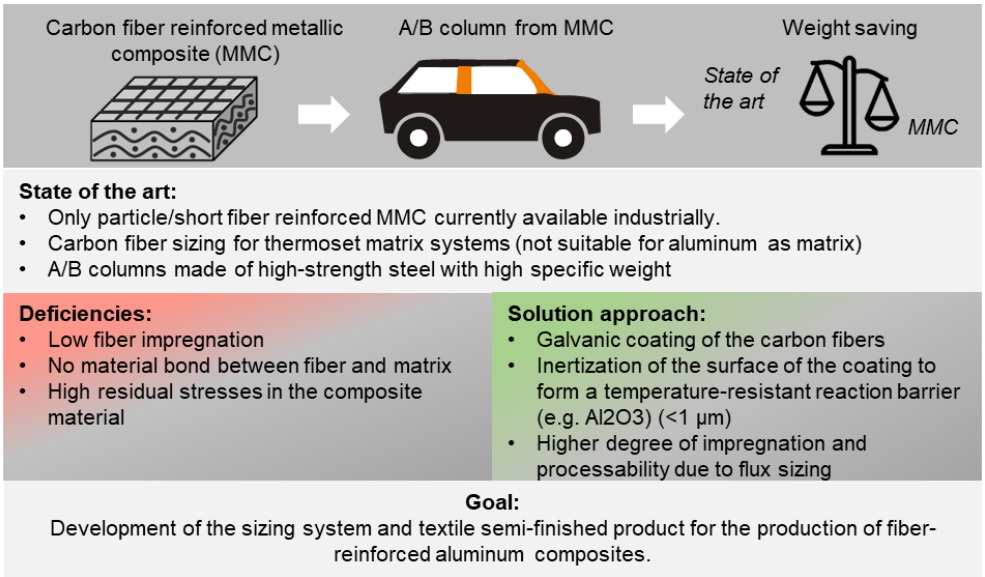
Mission Statement

Metal matrix composites (MMC) are a promising high-performance material for mobility and transport applications due to their fatigue and wear resistance as well as temperature resistance (up to 1,000 °C for titanium matrix) combined with low specific weight. Reinforcement with particles, short or continuous fibres can significantly increase the stiffness and strength of the metal matrix. Ceramic, silicon carbide and boron fibres or carbon fibres can be used as reinforcing material. Of the fibres mentioned, continuous fibre-reinforced carbon fibres (CF) offer the greatest potential for increasing the specific strength or stiffness of cast aluminium components used in lightweight construction. At the same time, the coefficient of thermal expansion can be specifically adjusted by reinforcing with carbon fibres depending on the fibre volume content. According to the current state of the art, components made of MMC exist exclusively with reinforcement by small particles or short fibres. The low matrix-fibre adhesion between continuous fibres and a metallic matrix has so far prevented the industrial production of MMC with continuous fibres. However, due to the high strength and stiffness of carbon fibres, MMCs reinforced with carbon fibres show great potential in applications where polymer-based fibre-reinforced composites (FRPs) reach their limits. Potential areas of application are particularly in the automotive sector and in aerospace, as the lightweight factor combined with high mechanical properties is of particular relevance in these sectors. The use of MMC enables the development of new drive technologies (e.g. lightweight and wear-

resistant engine parts) and also offers potential for use in multi-material systems (e.g. through the connection with a monolithic aluminium component or an FRP structure). Furthermore, MMCs are easier to recycle from a technological and economic point of view compared to polymer-based fibre composites.

Approach

Within the framework of this research project, novel cast MMCs with carbon and glass continuous fibres are being researched for industrial use. Three key factors are responsible for the quality of a MMC: the matrix, the reinforcing fibre and the interface between the two components. The nature of this interface determines the mechanical properties of the composite material, as it is responsible for the load transfer from the weaker matrix to the reinforcing fibres. Generally, a medium interfacial strength is aimed for. Low values do not allow load transfer from matrix to fibres, too high values lead to brittleness of the composite material.



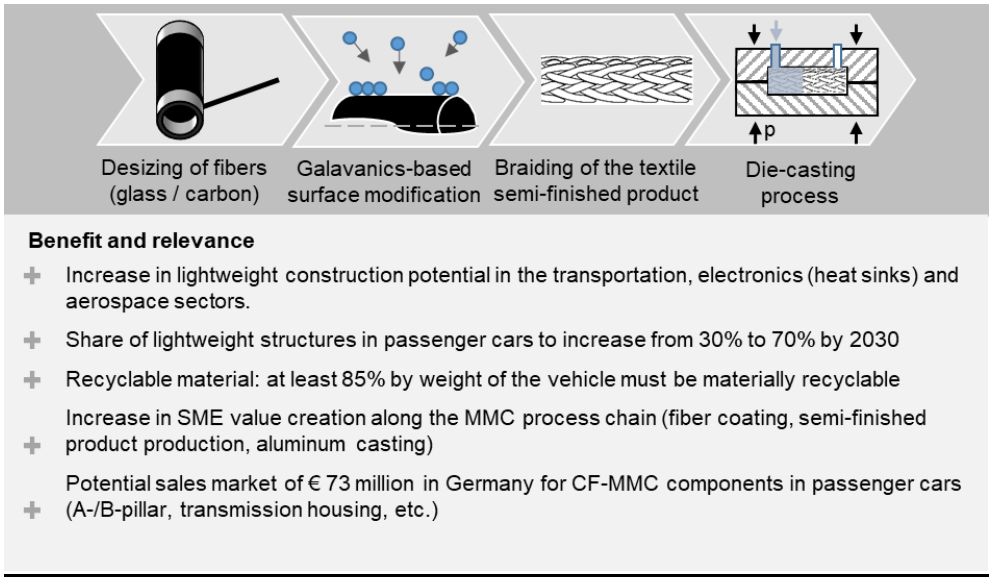


Figure 1: Mission picture of the MMCCast project

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