



ARMOR PLATING AND REPAIR OF ALUMINUM DIE CASTING MOLDS WITH LASER MATERIAL DEPOSITION

Task

In aluminum die casting, liquid aluminum is pressed into a mold under high pressure. The mold, often made of steel, is the negative of the casting to be produced and exposed to high stresses due to corrosion and wear during its service life. Depending on the size and complexity of the mold, the molds can weigh up to several tons. Furthermore, the costs to manufacture them are in the range of several hundred thousand euros, making replacement and the associated loss of production time-consuming and, thus, costly.

To increase component life, Fraunhofer ILT is using laser material deposition (LMD) to armor plate the molds. This effectively protects the workpiece edge zone against corrosion and wear. Furthermore, if damaged, the mold can be repaired in a cost- and time-efficient manner by rebuilding defective component areas using LMD.

Method

Fraunhofer ILT investigates different process strategies to produce coatings that are as thin as possible, resistant to corrosion and wear, and that have adapted thermal conductivities. The coating is applied close to the final contour to minimize post-processing and speed up production of the mold. The coating material used was a metal matrix composite consisting of a ductile Ni-based matrix with embedded tungsten carbide hard materials, for which the institute investigated different mixing ratios of the two components in the coating.

Results

By developing suitable process strategies, Fraunhofer ILT has been able to apply coatings with layer thicknesses between 300–600 μm and a mixing ratio of up to 50 vol% tungsten carbide content in the Ni-base matrix to steel molds. After the armored molds were subsequently machined, field tests demonstrated that component service life increased significantly.

Applications

In addition to applications in the fields of forming and master molds, the process is suitable for numerous components and industries in which heavy-duty components have to be coated or repaired, e.g. in the fields of power generation, hydraulics, rolling or housing construction. The coating properties can be flexibly adapted to the specific application since a large number of materials can be processed.

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3 Steel mold coated by laser material deposition.

4 Cross-section of the applied coating on the steel mold.