AMC
AMERICAN METALCASTING CONSORTIUM

Success of Die Coatings Produce Significant Savings

Program Overview and Objectives: "Advanced Engineered Coatings with Extended Die Life for Tooling" is an AMC Innovative Casting Technologies project sponsored by the Defense Logistics Agency. It is a collaboration between AMC, the North American Die Casting Association (NADCA), The Colorado School of Mines (CSM), Mercury Marine, and Phygen Coatings. The objective of this project is to enhance the development of non-sticking and self-lubricating coatings for metal molds to reduce cycle time, decrease process costs, and improve part quality.

SUCCESS STORY

Problem: In the die casting process, the application of lubricant can reduce the quality of castings, increase processing time and costs, reduce die life, and create environmental issues.

Solution: Physical Vapor Deposition (PVD) coatings previously developed at CSM and leveraged through funding from DLA on die cast dies have resulted in faster cycle times, a reduction in the use of release lubricants, and a reduction in surface defects on the resulting castings. In 2017, for example, PVD coating of a Balance Shaft Housing die at Mercury Marine resulted in fewer surface defects and several other process improvements. In contrast, uncoated dies used to produce the same part typically required significant maintenance such as solder removal, and re-welding of small pieces in critical areas on at least three separate occasions by the time 70,000 castings had been produced. The low level of heat checking on the current CertiPhy Plus ALCRN PVD coated die indicates that maintenance cost savings will continue to grow.

Balance Shaft Housing after more than 70,000 castings have been produced in the die (photograph by Phygen)

Benefits: The use of PVD coatings has directly resulted in documented cost savings. Cost savings calculations have been performed based on the 70,000 shots produced at Mercury Marine. These savings are listed in the table below as a percentage of the initial purchase price of the cavity inserts. Subtracting the cost of applying the coating resulted in a total savings of about 25% of the cost of the die inserts. In summary, PVD coatings have been shown to minimize die soldering, sticking, and dragging. Furthermore, the investment in fully coating a die can be readily recovered from resulting process improvements.

Item	Reduced Die Repair	Reduced Die Lubricant	Faster Cycle	Extended Die Life	Cost of Coating	TOTAL SAVINGS
Savings Over 70,000 Shots (as a percentage of original tool cost)	10%	5%	5%	25%	(20%)	**+25%**

"At 70,000 shots, the tool has shown very little wear and looks like a die with less than 20,000 shots."

Alex Monroe, Technical Specialist Engineer, Mercury Marine, Fond du Lac, WI

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