AMC

AMERICAN METALCASTING CONSORTIUM

Coatings Provide Die Life Improvement and Reduced Safety Risk

The American Metal Casting Consortium (AMC) and the North American Die Cast Association (NADCA) have sponsored research and development of coatings for Die Cast Components. These Coatings were originally developed to be solder resistant in the die cast process. Under the AMC Casting Solutions for Readiness Program (CSR), Additional Testing and refinement of the coatings have now proven out as method to improve Die life and safety concerns on large transmission castings.

SUCCESS STORY

Problem: The Making of die castings requires the use of a die release agent that also doubles as a cooling agent to remove die castings from the mold after each cycle. Without that release agent and cooling, the molds are prone to soldering, heat checking, and having the castings stick in the mold. The majority of these release agents are water based and when spraying them on the mold, cools the surface of the mold and creates heat checks (micro-cracks in the surface of the mold) These Heat checks cause the mold to be replaced at a higher frequency due the safety concern of handling the castings with sharp heat checks on the surface of the casting.

Solution: Several physical vapor deposition (PVD) coatings were developed specifically for the reduction of water-based, die release lubricants on die components. Based on results of NADCA studies, the FCA team implemented a duplex die coating in an attempt to improve the life of the tool. The duplex coating consisted of a nitride surface treatment followed by a PVD ceramic coating. The research was conducted by The Colorado School of Mines (CSM) on aluminum adhesion to PVD coated steel when molten aluminum is applied to those coated components. The coated components have shown little to no adhesion to coated steel plates without application of any water-based die release lubricants. By reducing the amount of spray on the die components, this reduces the expansion and contraction of the die surfaces on a shot by shot basis. This reduction then leads to a slower formation of heat checks on the die surface.

Benefits: At Fiat Chrysler Automotive (FCA) Kokomo die casting facility they have applied coatings to die cast tools that have had severe heat checking causing them to remove the tools from service. After completion of a coating and a process development phase on a Rear Wheel Transmission Case, FCA's engineers developed a process that has increased the life of a Rear Wheel Drive transmission casting from 30,000 shots to 60,000 shots. Effectively doubling the life of the die and reducing the safety handling concern due to excessive heat checks on the surface of the casting. The success of the coating lead to tooling cost reductions of $240k annually, as well as increased machine uptime and product quality.

""The duplex coating has worked great in this application. We have been able to reduce tooling costs and maintenance activities, while also producing a better quality product for our customer. We plan to implement the coating in other tooling based on this success."

Corey Vian, Engineering Group Lead

NADCA NORTH AMERICAN DIE CASTING ASSOCIATION

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