AMC
AMERICAN METALCASTING CONSORTIUM

USING ADVANCED SILICON-DOPED DIAMOND-LIKE CARBON (Si-DLC) COATINGS TO IMPROVE CORE LIFE AND CASTING THROUGHPUT

Introduction: Better die coatings can improve quality and extend die life, resulting in lower cost per part for the Defense Logistics Agency (DLA). *Advanced Engineered Coatings with Extended Die Life for Tooling* is an AMC project sponsored by the DLA. It is a collaboration among AMC, the North American Die Casting Association (NADCA) and the Colorado School of Mines (CSM) to evaluate new advancements in coating technologies and materials for use in aluminum die casting.

SUCCESS STORY

Problem: In the aluminum die casting process, the molten aluminum aggressively reacts with the hot work tool steel molds used for forming the casting. The phenomenon of the cast aluminum reacting and adhering to the surface of the tool steel is known as soldering. When soldering occurs on the surface of a die, the integrity of the resulting casting is compromised from disruption of the dense skin effect that occurs during solidification, which in turn can lead to leaks and/or geometric defects.

Solution: Based on findings from this project, two core pins used in the manufacture of transmission castings were selected for an in-plant trial at Stellantis (Figure 1). These pins were coated with a silicon-doped diamond-like carbon coating (Si-DLC) and the core pins put into service (Figures 2 - 4). Figure 5 shows the *Before* and *After* coating application conditions.

Figure 1

Figure 2 Figure 3 Figure 4

Benefits: The coated core pins were significantly better at resisting soldering. Standard core pins exhibited severe soldering after 2,500 cycles while the coated pins only began to show the onset of solder after 2,500 cycles and have proven to last as long as 10,000 cycles in long-term production runs. In addition, the occurrence of leaking castings attributed to the soldering of these cores has been reduced to one third of previous levels.

Before

After

Figure 5

The core pins made with the Si-DLC coating are vastly superior to the traditional cores. These cores have helped improve our throughput and quality on this product. - Dr. Corey Vian, Stellantis

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