

Aerospace Manufacturers Put Their Trust in AMG

In aviation, even the smallest component can influence the safety performance of an aircraft. Products of all shapes, sizes and materials can impact performance, and the slightest miscalculation can cause disastrous results.

One very important and unique method used to manufacture specific aerospace components is electroforming, which is one of AMG's core capabilities.

Electroforming is a form of additive manufacturing that can be thought of as 3D printing through chemistry. Rather than building up a part by melting macro materials as in traditional 3D printing processes, electroforming builds up a part on a micro rather than macro scale, literally depositing one individual metallic atom at a time.

In an electroforming process, parts are built using a substrate called a mandrel, which is an inverse model for the component. The electroforming system is comprised of an electrolytic nickel containing solution – which is frequently referred to as a bath – as well as anode baskets that provide the nickel metal for deposition. With the mandrel placed in the bath acting as the cathode, an electric DC current is then applied across the electrodes, causing the nickel anodes to dissolve, while driving metallic ions in the solution to migrate and deposit directly on the mandrel's surface, bonding together into thicker and thicker layers to achieve the desired thickness and profile. When the process is complete, the unit is removed from the solution and the finished metal part is removed from the mandrel.

While electroforming is commonly used in aerospace production, it's not usually evident to the common traveler. For instance, a Texas company that manufactures launch vehicles and other products for commercial and government customers used AMG services on a large rocket thrust chamber. AMG used its advanced electroforming capabilities to develop a thick layer of nickel-cobalt over a large copper thrust chamber, encapsulating cooling passages and providing structural stability to the chamber.

The process is also used to manufacture leading edge guards, which are used for rotor, turbine and propeller blades and vanes. Many electroformed products are made with nickel-based alloys, which resist higher temperatures, corrosion and constant wear – all of which impact the performance of aircraft such as helicopters. Different additives impact the tensile strength and stress properties of the component being manufactured.

Unlike 3D printing, electroforming offers large production run capabilities. When the parameters of the electroforming process for a part have been established, it's easy for AMG to scale up for larger production runs. Larger parts can also be easily addressed by simply increasing the size of a tank, as in the case of the previously mentioned rocket thrust chamber. 3D printing on the other hand may require significant capital investment to address both capacity and more importantly size of part.

Electroforming also minimizes waste. When the component is complete, it is removed from the mandrel, which is reused to make the next component. Unlike 3D printing, electroforming produces very little waste to be recycled.

One other aspect of electroforming makes it an important process for manufacturing aerospace components. A common term used in electroforming is that of “product of the tool”. By using a micro scale chemical deposition process, electroforming can very accurately mimic the surface of the mandrel, which therefore means accurately meeting the specifications for the internal profile/surface conditions of the final part.

The aerospace industry requires rigorous controls of materials and tolerances to assure quality, reliability and safety, which can all be addressed with electroforming. AMG has extensive experience working with OEM and Tier 1 and 2 aerospace customers to meet exacting specifications to provide high precision and high quality components. From the smallest part to the largest, it's critical that aerospace manufacturers use reliable products from trusted partners.