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Advanced materials and technologies in aviation industry

Tomasz Kurzynowski, Wojciech Stopyra and **Andrzej Pawlak**
Wroclaw University of Science and Technology, Poland

Additive Manufacturing (3D printing) offers the possibility of producing individually designed products that perfectly fulfill their functions – even the most complex ones. AM uses layered production techniques to produce functional finished parts. This process facilitates building of a part from materials that are difficult to machine and enables the production of complex parts for demanding industries such as aerospace. This direction of AM technology development is related to the ability of producing any geometric structure and to use a wide range of processing materials, including typical "aerial" materials used to reduce mass, such as aluminum, magnesium and titanium alloys. It clearly shows the growing impact on the cost of two main factors: 1. use increasingly advanced and expensive materials and 2. technological, construction and assembly work. The use of magnesium for aviation applications is an opportunity to meet the high requirements and mass reduction of parts. The density of magnesium (1.77 g/cm^3) is almost twice as low as conventional aluminum (2.77 g/cm^3). Considering mechanical properties of magnesium (E=34 GPa, hardness 0.6-0.95 GPa), it is characterized by excellent strength-to-weight ratio (specific strength). This is the reason why in advanced areas of industry where the mass of products is crucial, magnesium alloys are the desired materials. Additive technologies (AMs) processing metals, plastics and composites that are currently in advanced development stage (or even commercially availabe) may have a huge impact on the cost of aircraft components by reducing the "buy-to-fly" ratio and eliminating some production, assembly and logistics activities. This is closely related to the capabilities of additive technologies, including: 1. the ability to create extremely complex shapes, spatial internal structures, etc., which reduce the weight of a product by up to 50% compared to conventional methods. 1. the possibility of producing one component that replaces a functional collection of several or even a dozen components made using traditional methods. 2. raw material savings – the amount of material needed (e.g. titanium or aluminum alloy) is only slightly larger than the volume of produced parts; additive technologies do not generate material waste as opposed to traditional technologies like machining, where losses can reach as much as 90% of the input material.

Biography

Tomasz Kurzynowski completed his PhD 6 years ago from the Wroclaw University of Science and Technology, Poland and a professional development program from the Stanford University, USA. He is the Manager of Metal Additive Manufacturing Technology and Materials Laboratory, a Member of the Board of the Science Infrastructure Management Society. He has published more than 20 papers in reputed journals and over 150 industrial experises. His current research interest include additive manufacturing technologies and design methods for functional optimization or weight reduction of designed or reengineered parts, especially for the aerospace industry..

tomasz.kurzynowski@pwr.edu.pl

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