

Aerospace

Composite Materials: Flying High!

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Saving weight is currently a huge challenge for the aerospace industry. Enhanced performance, reduced fuel consumption and lower emissions can offer manufacturers major advantages in a competitive market and the use of composite materials offers opportunities in all these areas.

After experiencing a slump for many years following 9/11 and the global recession, the global airline industry has been experiencing very strong growth in the last 3-4 years. But rising fuel prices, dull economic conditions and increasing competition are realities that are biting into the revenue-generating potential of the global airlines business today. One way for aircraft manufacturers to address these issues is weight saving which reduces both fuel consumption and the impact on the environment. This has led to a 50 percent increase in the use of composite materials in the latest generation of commercial aircrafts.

Composite materials are essentially a combination of two or more dissimilar materials that are used together in order to combine best properties, or impart a new set of characteristics that neither of the constituent materials could achieve on their own. The composite technologies are able to address a very wide range of issues, such as reducing the weight of existing metallic parts, avoiding corrosion, and designing out noise and vibration.

“Composite materials are important to the aerospace industry because they provide equal or greater structural strength comparable to metal components as well as lesser need for replacement,” says Scott Causey, Aerospace Specialist at Seco. “These lighter weight components allow increased fuel efficiency and reduced repair cost and they offer the same or higher strength components with reduced weight.”

Composite materials typically found in aircrafts are carbon fiber, glass fiber and Kevlar (aramid) fiber in structural components, along with ceramic matrix composites which are typically used in brake components, combustion components, and exhaust components.

“Composites can typically reduce the overall structural weight by 20-50 percent which improves the fuel efficiency,” says Causey. “Composites also provide lower costs for assembling components because it requires very few fasteners, bolts etc. and in some cases consolidates multiple metal components into one composite component.”

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At the same time, the use of composite materials offers a number of challenges for aircraft manufacturers.

“Like metal machining, composites have their unique manufacturing requirements that must be maintained to ensure part compliance,” says Causey. “This along with advanced automation processes to help reduce manufacturing costs is ever evolving, which in most cases allows only dedicated manufacturers to fabricate composites as they can invest in advanced technology specifically for these materials and support ever-growing aircraft build rates.”

Seco’s offering consists primarily of diamond-coated carbide end mills. These tools have features that

allow the tool to create a very good surface quality while maintaining a very high speed and feed. Also, SECO offers PCD (Poly-Crystalline-Diamond) brazed cutting edges, offering optimized tools for difficult cutting conditions on challenging workpiece materials.

Common problems when drilling composite materials are delamination, splintering and bad surface finish. By applying optimized point geometries, the quality of the hole is improved and secured while the diamond coating or PCD achieves competitive cutting data and extended tool life. Seco has recently launched two new, standardized machine tools for hybrid stack materials: JC898 and JC899. The rougher — JC898 — is a high-feed tool with a through-coolant channel for removing the excess material with compressed air. The finishing tool — JC899 — has a patented double geometry design and machines a (circular) side milling cycle to finish the components.

Looking into the future, it is clear that the aircraft industry will keep demanding lighter, more efficient aircraft. Eventually, we may see aircraft constructed entirely of composites rather than metal, but for now, aircraft are still only part metal, part composite. "Short-term, I think what we will see is the development of processes and applications for the use of recycled materials and ongoing material to optimize manufacturing costs, as composite materials are still expensive to fabricate," says Causey.

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