

EFFECT OF GEOMETRICAL STRUCTURE AND PROPERTIES OF COMPOSITE COMPONENTS ON DRILLING OF VARIOUS COMPOSITE MATERIALS

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Summary: Machining of composite materials is significantly different from machining of metals due to their specific structure. A composite material consists of at least two different components, of which machining properties are almost always different. Phases – the composite structural components are characterized by different shape, size, volume fraction but also geometrical arrangement of individual components in a given composite. As a result of the above mentioned properties, in the process of machining of composites, the cutting edge of the tool (e.g. a drill bit) comes across materials of different mechanical properties, whereas their mutual interaction takes place at different angles, which has a significant impact on the whole process. A good case in point here is machining of fiber-reinforced composites. Irrespective of the geometrical arrangement and fiber orientation in the composite, the cutting edge of the drill bit, which rotates about its own axis, cuts reinforcement fibers at different angles, in the range of 0° to 90°. The characteristics of mechanical machining of fibers at those angles are different, therefore the geometrical parameters of advanced special drill bits need to be properly modified to allow for effective machining processes and desired quality of the product.

This study describes the results of drilling of elements made of composite materials of various structure, including CFRP, GFRP and GLARE composites. The work proves that it is necessary to design new drill bits with unique geometry making allowance for the impact of the properties of composite components as well as determining the mechanism for their machining at different angles, drilling in parts of flat and non-flat surfaces in order to eliminate failure mechanisms such as cracking, fiber pull-out or delamination.

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