

عنوان مقاله:

Ultrasonic Assisted Drilling of Carbon Fiber Reinforced Plastic Composites with Non-Rotating Vibratory Tool

محل انتشار:

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خلاصه مقاله:

In recent years, the use of various polymer composites in the aerospace, marine, and automotive industries have expanded due to their low weight and high mechanical strength. Due to hard phases and layered-type material structure, problems like poor surface quality, high cutting forces, and severe tool wear occur in the drilling of carbon fiber reinforced composites. A method that can reduce the mentioned effects in CFRP drilling is using ultrasonic waves in the drilling. In this paper, the idea of using a non-rotating vibratory tool ultrasonic method for drilling CFRP has been introduced and the effect of exerting ultrasonic waves on non-rotating drilling tool has been studied. The composite specimens were prepared by the layering method under load. The design of experiments using the Taguchi method was carried out, the optimal drilling parameters were determined, and the effects of ultrasonic on the surface roughness, surface quality (delamination, cracks, un-cut fibers), and cutting forces were investigated. The results indicated that ultrasonic waves in CFRP drilling could significantly reduce surface roughness (up to ۴۹% surface roughness improvement) and the average axial force could decrease up to ۵۷% compared with the condition that no ultrasonic waves have applied. Delamination of the drilled surface also decreased with the use of ultrasonic waves. This indicates that the idea of non-rotating ultrasonic tool can have similar effects as a rotating ultrasonic tool in drilling CFRPs.

کلمات کلیدی:

Ultrasonic, CFRP, Drilling, Delamination, Cutting force

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