High effective laser assisted ultra-precision machining of brittle materials

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ABSTRACT

Laser assisted diamond turning is a potential approach to enhance the surface quality with complex geometry on the hard and brittle materials and prolong the tool life. A high effective laser assisted turning (HE-LAT) method is presented in this invited seminar, which guides the laser beam refracts at rake face, cutting edge, and total reflects at flank face. The HE-LAT method possesses effectively improved laser heating efficiency and can be employed to achieve the homogeneous optical surfaces on hard and brittle materials. The nanoscale constitutive model of binderless WC has been obtained based on the high-temperature nanoindentation tests, which facilitates the workpiece thermal filed prediction cooperating with the relevant HE-LAT FEA model. The experimental results indicate that the HE-LAT method benefit eliminating the surface fluctuation effectively, thereby achieving better surface finish quality down to less 1 nm in Sa on binderless WC. The diamond local graphitization can also be prevented owing to the lower essential laser power and suppressed chip adhesion problem.

The achievements made can be widely used in optical and medical industries.

Biography

Professor Fengzhou Fang has been working in the fields of freeform optics design and manufacturing, bio-medical devices design and manufacturing, micro/nano manufactuirng and metrology since 1982 when he became a faculty member at university. He is the founding president of the International Society for Nanomanufacturing (ISNM), the president of the International Academy of Engineering and Technology (AET) and the editor-in-chief of Nanomanufacturing and Metrology (NMME). He is a fellow of AET, CIRP, SME, and ISM.