

# Theory and method of plastic domain cutting and defect control of micro-nano structures

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*Micro/nano-structures have enormous application potential in detection, illumination, and optical communication due to their efficient optical manipulation capabilities. Diamond tool cutting is the best method for ultra-precision fabrication of complex-shaped micro/nano-structures. The defects such as cutting-caused deformation and material residue in micro/nano-structure machining are related to the non-free cutting state of micro/nano-structures and the plastic flow of materials during processing. Therefore, it is necessary to study the non-free cutting mechanism of micro/nano-structures. This paper analyzes the principles of non-free cutting, and reveals the shear interference, chip formation, and material removal mechanisms under the effect of non-free cutting. Ultimately, the formation mechanisms and evolution laws of cutting-caused deformation and material residue in micro/nano-structure machining were determined. Therefore, ultra-precision cutting of various complex-shaped micro/nano-structures was achieved through the optimization of processing technologies in planing and fly-cutting.*

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