Atomic observation of structural evolution of turning aluminum surface during ion beam bombardment

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Revealing structural evolution of turning aluminum surface during ion beam bombardment will benefit the optical surface quality modulation of aluminum, which is significant but challenging. In this paper, we present a molecular dynamics study on structural evolution and atom diffusion during ion beam bombardment. Metamorphic layer will generate during single point diamond turning causing massive sub-surface defects, which increases with the turning depth. During ion beam bombardment, the defects will perish with cascade collision. Thus, local stress will be released. Atom diffusion will be blocked by subsurface defects, which will decrease the degree of cascade collision. The whole surface presents a more stable state, which will benefit the surface roughness control during ion beam bombardment, thereby inducing a better finishing surface quality. The work gives an atomic-level insight into the structural evolution of turning aluminum surface during ion beam bombardment. The results provide guidance for the application of ion beam bombardment in the fabrication of high-surface quality of aluminum optics.