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Surface Modification by Water Vapor Plasma for Damage-free Roughness Smoothing of 4H-SiC[1] KAZUYA YAMAMURA, Osaka University, TATSUYA TAKIGUCHI, MASAKI UEDA, AZUSA N. HATTORI, NOBUYUKI ZETTSU — We have proposed a novel machining method combined with the irradiation of atmospheric pressure water vapor plasma for the finishing of hard materials, such as SiC, tungsten carbide (WC) and alloy tool steel. The irradiation of helium-based water vapor plasma modified the surface of 4H-SiC (0001), and a ball-on-disc test using an alumina ceramic ball revealed that the wear rate of SiC, the surface of which was modified by the irradiation of water vapor plasma, is 20-fold higher than that of the surface without plasma irradiation. The XPS measurement reveals that the surface irradiated water vapor plasma is oxidized, and nanoindentation test result indicates that hardness of that surface decreases in one order of magnitude. Plasma-assisted polishing using CeO_2 abrasives enabled us to smooth the surface roughness of 4H-SiC without introducing crystallographical subsurface damage, and a scratch-free surface with a roughness of less than 0.15 nm rms was obtained.

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