Unraveling the material removal and step morph ology evolution mechanism of plasma processed sapphire surfaces

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Sapphire (Al_2O_3) can be used in many fields, such as semiconductor, national defense and precision optics. Becaus e it has excellent corrosion resistance, wear resistance, and light transmission. However, it is a typical difficult-to-machine material due to its high hardness and brittle characteristics. In order to pursue better performance of sap phire components, the atomically smooth surfaces of sapphire are necessary for them. In this work, the inductively coupled plasma (ICP) polishing in atmospheric environment was conducted on sapphire materials. The results sho w that the plasma continuous processing time is a key factor for removing the defect layer of the original sapphir e surface. Multiple accumulations processing cannot achieve similar polishing quality with a single processing even though the total processed time is same. Besides, the surfaces after plasma processed topography exhibit direction al etching pits. Furthermore, the effect of oxygen-containing groups in plasma is analyzed on the surface topograp hy of sapphire. The step morphology of sapphire was achieved by tuning the processing parameters of plasma.

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