BCl_3 based ICP Etching of (100) β-Ga_2O_3 flake

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Ga_2O_3 has emerged as an alternative candidate for high power and high temperature device due to its large bandgap energy of 4.9 eV and high critical breakdown field of 8 MV/cm. The Baliga's figure of merit is about 3400, which is 4-10 times higher than those of GaN and SiC. The inductively coupled plasma (ICP) etching behavior of (100) β-Ga_2O_3 flake which were prepared by mechanical exfoliation of the bulk Ga_2O_3 substrate has been investigated. The etch rate of (100) Ga_2O_3 flake increased with rf bias power up to 52 nm min^{-1} under 25 sccm BCl_3/15 sccm N_2 gas chemistry. The etch rates of other crystal planes such as (010) and (-201) were also examined under the same ICP etching condition. The (100) Ga_2O_3 flake has the lowest etch rate compared with (010) and (-201) planes. The ICP etched (100) Ga_2O_3 plane maintained a smooth surface, and the RMS (root mean square) roughness was 1.5 nm over a broad range of AFM (atomic force microscope) scanning range.