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A segmented-blade ion trap with biasing rods

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We report the numerical simulation, fabrication process, and characterization of a segmented-blade trap with biasing rods [1, 2]. Our homemade trap consists of two radio frequency blades, dc blades with ten separate electrodes, and two biasing rods for compensating the ions' micromotion. We explore the effect of the rods on the trap potential and the influence of trap misalignment. The trap fabrication process is presented, including laser machining of an alumina substrate, metal deposition, and gold electroplating. We characterize the properties of both the bulk and surface of the substrate. An X-ray diffraction measurement reveals that the substrate is an alpha-alumina sintered above 1,200 degrees Celsius; the loss tangent is directly measured to be ˜0.01 near 20 MHz; and we obtain the surface roughness of the polished substrate 20˜30 nm. In this ion-trap device, we demonstrate the trapping of laser-cooled ytterbium ions successfully. We finally show our recent experimental results on the nonlinear motion of the ions and outline future research directions.

[1] M. Kim, K. Kim et al., AIP Adv. 12, 115006 (2022)
[2] J. Hong et al., Appl. Phys. B 129, 16 (2023)

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