

# Supplemental: Controlled Cryogenic Silicon Etching Using Pulse-Modulated Platen RF Power

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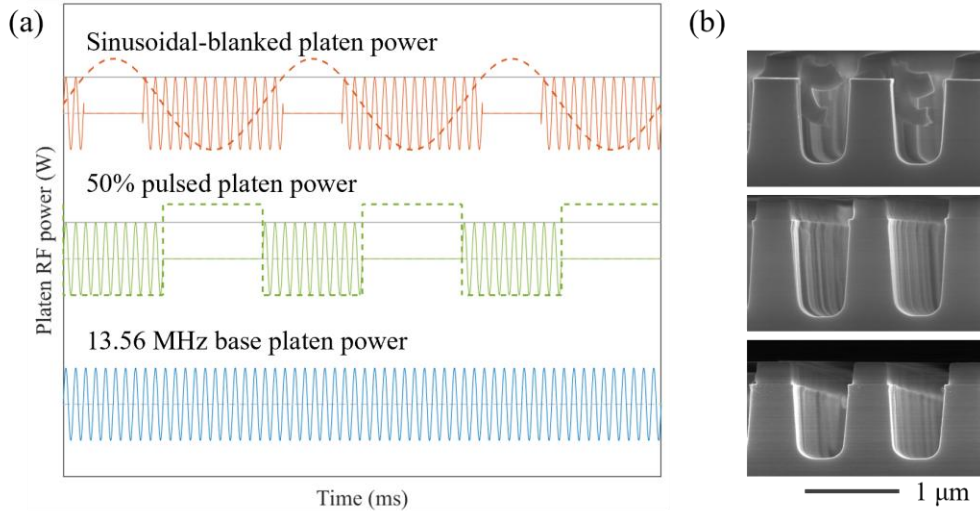


FIG. 1. EFFECT OF PLATEN RF POWER MODULATION ON CRYOGENIC SILICON ETCHING. (A) SCHEMATIC OF THREE PULSE-MODULATED RF POWER MODES OVER THREE PERIODS ( $0-6\pi$ ) OF THE MODULATION WAVEFORM. BASE RF FREQUENCY IS 13.56 MHz. TO MAKE BOTH THE MODULATION ENVELOPE AND BASE RF WAVE VISIBLE, ONLY 20 CYCLES OF THE BASE WAVE ARE PLOTTED PER PERIOD (NOT TO SCALE WITH THE ACTUAL  $\sim 13,560$  CYCLES). THE PULSE-MODULATED 50% DUTY CYCLE WAVEFORM (GREEN), THE SINUSOIDAL-BLANKED ( $\sim 70\%$  ON TIME EQUIVALENT) (RED), AND UNMODULATED RF DELIVERING DOUBLE THE ENERGY (BLUE) ARE SHOWN. (B) CROSS-SECTIONAL SEM IMAGES OF SILICON FEATURES ETCHED UNDER IDENTICAL CRYOGENIC CONDITIONS ( $-100\text{ }^{\circ}\text{C}$ , 15 mTorr, ICP 2000 W, PLATEN 15 W, 400 nm ZEP HARDMASK, 500 nm LINES AT  $1\text{ }\mu\text{m}$  PITCH).