

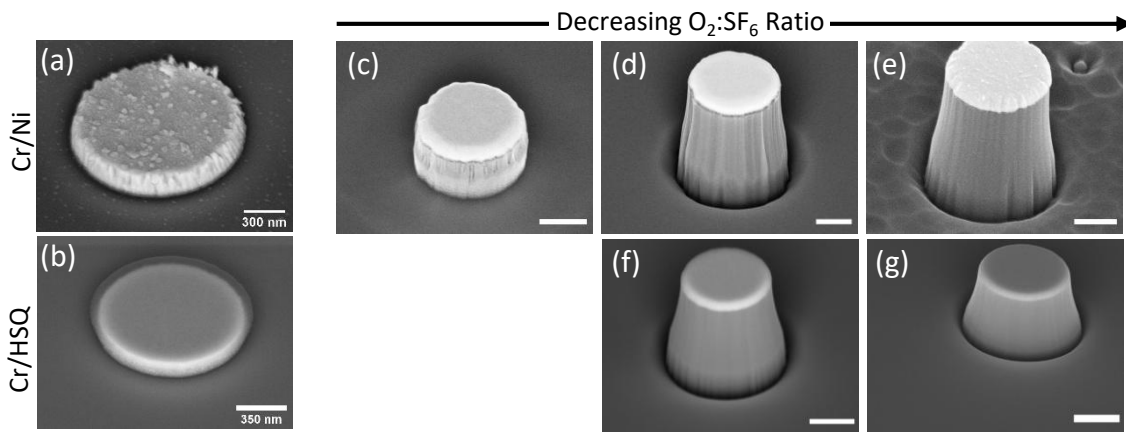


Fig. 1: SEM images of (a) a Cr/Ni hard mask fabricated by a liftoff process and (b) a Cr/HSQ hard mask fabricated by a Cl_2/O_2 ICP-RIE process. (c-g) SiC pillars fabricated by O_2/SF_6 ICP-RIE using (c-e) the Cr/Ni or (f,g) Cr/HSQ hard mask. Sidewall roughness decreases with decreasing $O_2:SF_6$ flow ratio while sidewall straightness decreases. Grain structure of the Cr/Ni hard mask appears to contribute to edge roughness that transfers to the SiC pillar, leading to striations in the pillar sidewall (c-e), whereas this effect is less pronounced for pillars fabricated using the Cr/HSQ mask and smoother sidewalls are achieved (f, g). Scale bars are 500 nm unless otherwise noted.

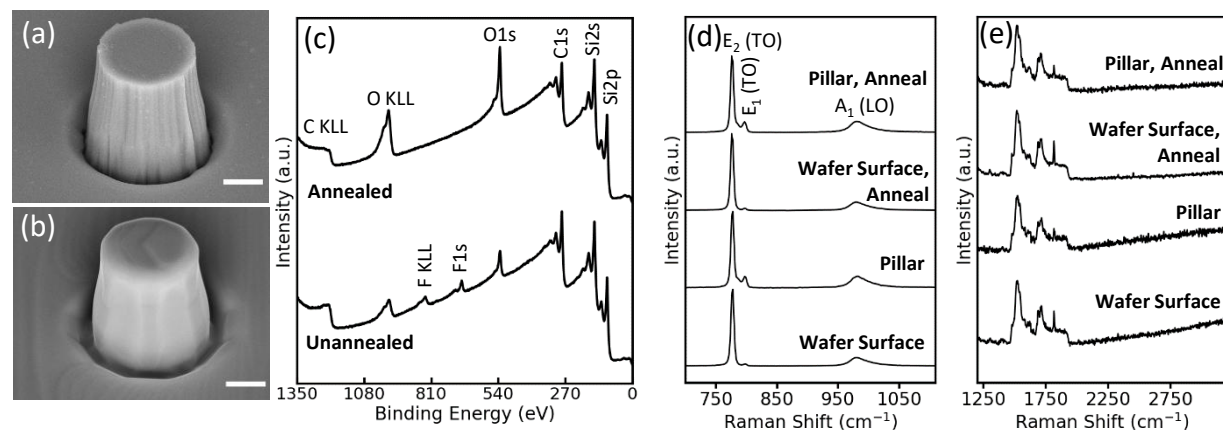


Fig. 2: (a,b) SEM images of a SiC pillar fabricated as in Fig. 1d (a) before and (b) after ramping to 1450 °C in 5 slm Ar, annealing for 1 min in 5 slm H₂, then cooling in 5 slm Ar in a SiC CVD reactor. After annealing, smoothing of the pillar sidewall is observed and faceting occurs. Annealing results in step bunching with AFM roughness of 1.2 nm RMS on the wafer surface (c) XPS survey spectra show removal of fluorine-related species after annealing. (d-e) Raman spectra taken in regions of the wafer surface and pillar before and after annealing show 4H-SiC peaks, and no graphitic carbon-related peaks are present. Scale bars are 500 nm.

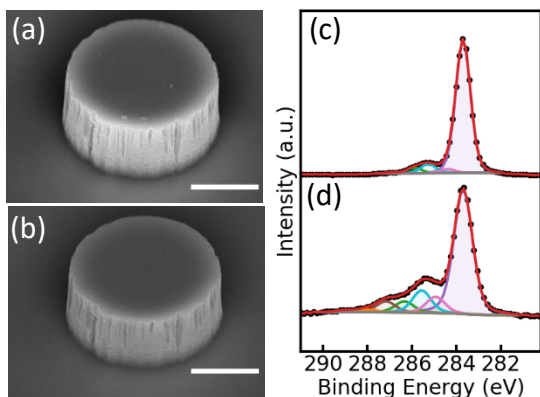


Fig. 3: (a,b) SEM images of a SiC pillar fabricated as in Fig. 1c (a) before and (b) after annealing at 1000 °C in 100 sccm O₂ for 2 min in an RTA followed by oxide removal in hydrofluoric acid solution. Faceting and step bunching do not occur after oxidation and oxide removal, however sidewall roughness remains. XPS C 1s spectra (d) before and (c) after oxidation and HF, show a reduction of oxygenated and fluorinated species after sacrificial oxidation and HF. XPS survey and F 1s spectra (not shown) indicate fluorine is not completely removed by this process. These results motivate additional study employing oxidation for longer durations. Scale bars are 500 nm.