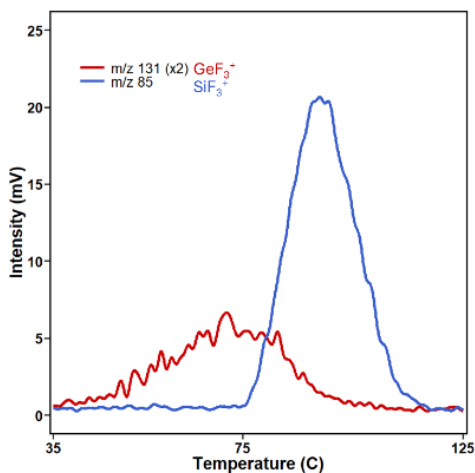


A) 1 Torr HF



B) 1 Torr HF + 1 Torr H2O

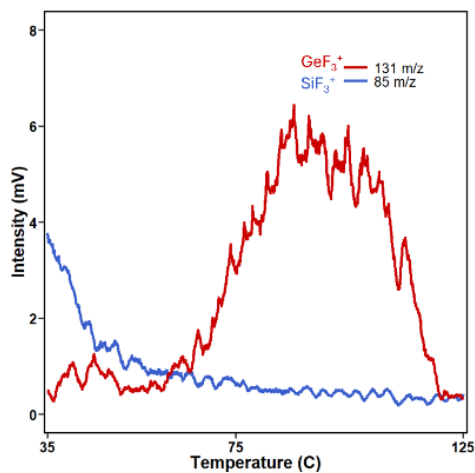


Figure 1: **A)** Temperature ramp of 1 Torr HF exposed to mixed Ge and Si powder from 35 – 125°C. Increase of GeF_3^+ signal demonstrated by m/z 131 peaking at ~65°C. Etching of Si by GeF_4 demonstrated by SiF_3^+ at m/z 85 peaking at ~95°C. **B)** Temperature ramp of 1 Torr HF & 1 Torr H_2O exposed to mixed Ge and Si powder from 35 – 125°C. Increase of GeF_3^+ signal demonstrated by m/z 131 peaking at ~95°C. Non-etch of Si via GeF_4 shown by no increase in SiF_3^+ at m/z 85 at temperatures where GeF_4 is present.

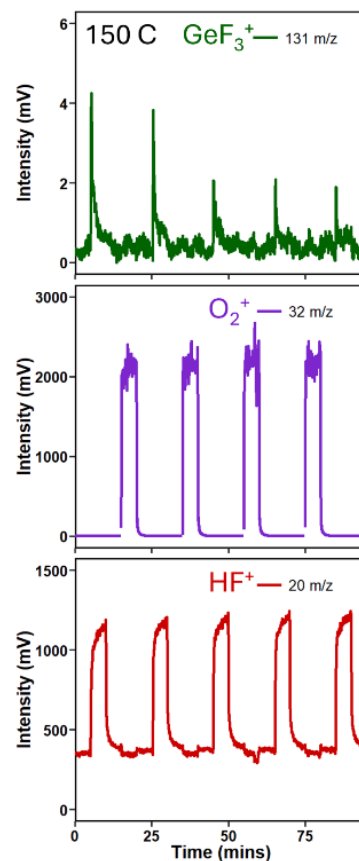


Figure 2: Isothermal etching of Ge powder at 150°C by alternating ~ 1 Torr exposures of HF and O_2 represented by HF^+ at m/z 20 and O_2^+ at m/z 32. During HF exposures initially and after O_2 doses, an increase in the GeF_4 intensity is observed as measured by the GeF_3^+ ion intensity at m/z 131.

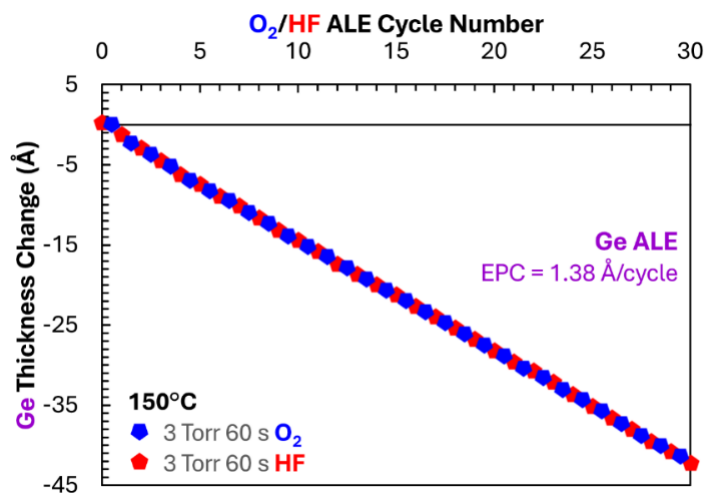


Figure 3: Alternating HF and O_2 exposures both at 3 Torr for 60 seconds demonstrating an ALE process. The etch per cycle of the Ge film is 1.38 Å/cycle.