# Ligand-Exchange and Etching Reactions Between Metal Fluorides and Silane Precursors Containing Different Ligands

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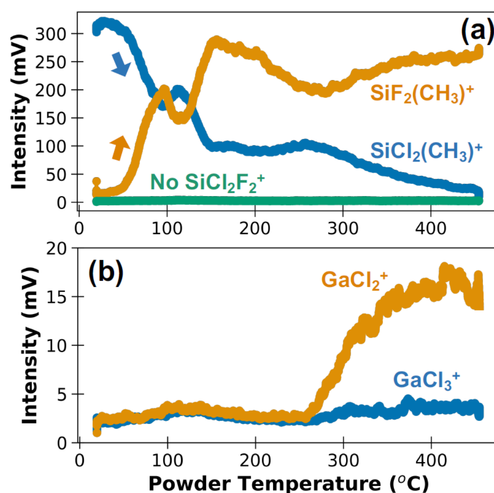


**Figure 1.** Ion intensities versus temperature during reaction between $SiCl_2(CH_3)_2$ and $GaF_3$ powder. (a) $SiCl_2(CH_3)_2$ precursor ($SiCl_2(CH_3)^+$), $SiCl_2(CH_3)_2$ precursor after complete F/Cl exchange ($SiF_2(CH_3)^+$), and $SiCl_2(CH_3)_2$ precursor after complete F/$CH_3$ exchange ($SiCl_2F_2^+$, not observed). (b) Metal etch product $GaCl_3^+$ and its fragment $GaCl_2^+$.

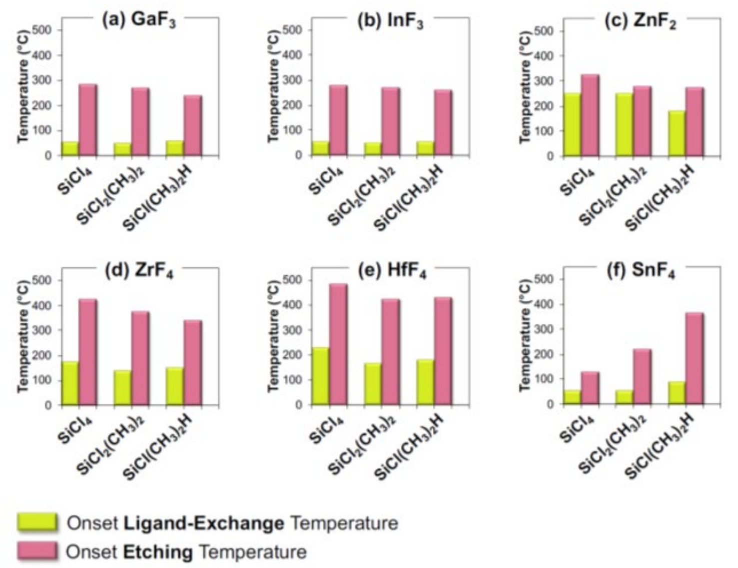


**Figure 2.** Onset temperatures for ligand exchange and metal etching observed for spontaneous etching of various metal fluorides using different silane precursors.