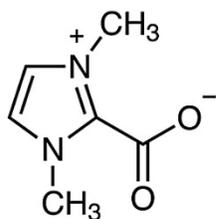
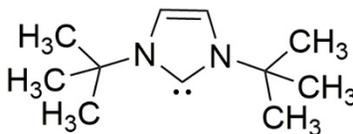


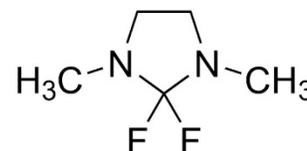
1,3-Dimethylimidazolium-2-carboxylate (**IMeCO<sub>2</sub>**)



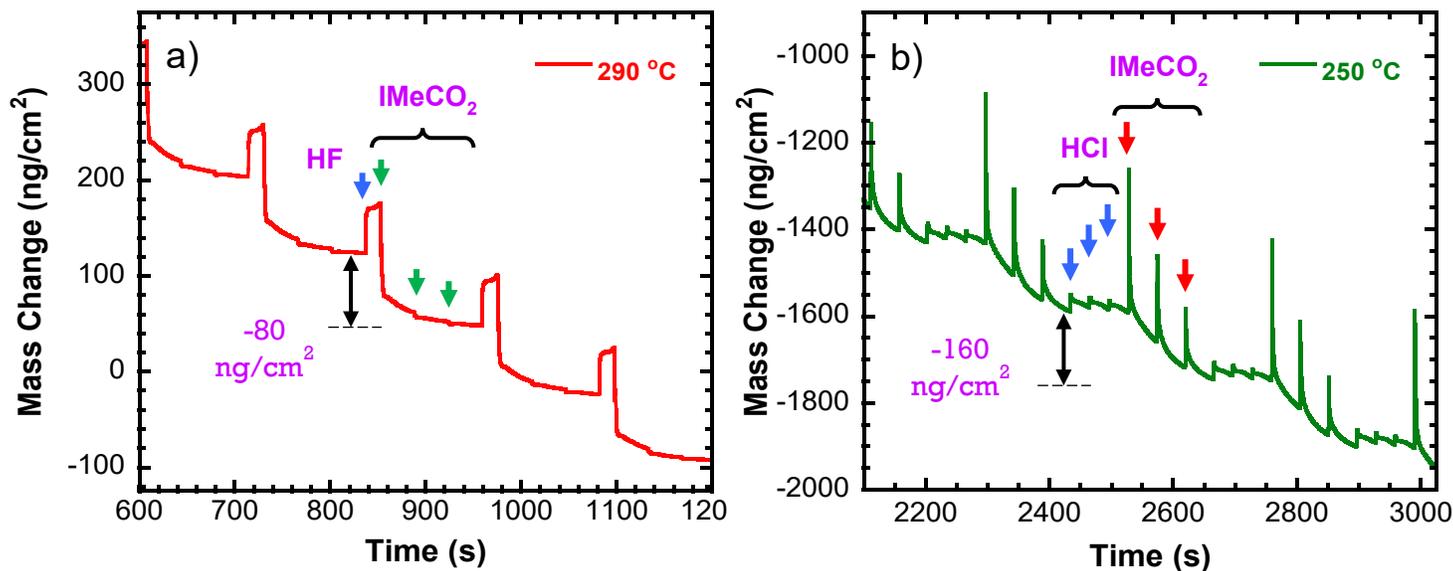
1,3-Di-tert-butylimidazol-2-ylidene (**tBu**)



2,2-Difluoro-1,3-dimethylimidazolidine (**DFT**)



**Figure 1.** Sources of NHC carbenes used during the etching processes.



**Figure 2.** QCM results from thermal ALE using NHC carbenes. a) Al<sub>2</sub>O<sub>3</sub> ALE using one dose of HF and three doses of IMeCO<sub>2</sub> per cycle at 290 °C. b) Au ALE using three doses of HCl and three doses of IMeCO<sub>2</sub> per cycle at 250 °C.