Epitaxial growth and structure of the high-k dielectric Pr$_2$O$_3$ on Si(001) and Si(111) JORG ZEGENHAGEN, LAURE LIBRALESSO, TIEN-LIN LEE, ESRF, France — Keeping the capacitance of CMOS devices constant while shrinking further the gate dimensions requires intolerably thin SiO$_2$ layers for next generation devices. Thus, replacing SiO$_2$ with a material with larger static permittivity $k$ and matching properties is at present a very urgent task. Among others, the sesquioxide Pr$_2$O$_3$ is discussed as a possible candidate material. We deposited ultra thin films of Pr$_2$O$_3$ by e-beam evaporation on atomically clean (001) and (111) surfaces. We studied the growth from the very early stages using low energy electron diffraction, scanning tunneling microscopy, Auger electron spectroscopy, grazing incidence X-ray diffraction, X-ray reflectivity and X-ray photoelectron spectroscopy. On Si(111), Pr$_2$O$_3$ grows pseudomorphically in the hexagonal phase. On Si(001) surface, a 0.6 nm thick layer of cubic Pr$_2$O$_3$ grows followed by the formation of a silicate layer on top. Growth under $10^{-8}$ mbar O$_2$ atmosphere is needed in order to prevent Pr-silicide formation.