Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Epitaxial growth and structure of the high-k dielectric Pr_2O_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_2O_3 is discussed as a possible candidate material. We deposited ultra thin films of $Pr_2O_3$by e-beam evaporationon 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_2O_3grows pseudomorphically in the hexagonal phase. On Si(001) surface, a 0.6 nm thick layer of cubic Pr_2O_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.

Jorg Zegenhagen
ESRF

Date submitted: 29 Nov 2005 Electronic form version 1.4