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Paramagnetic Centers in Hafnium Oxide Films on Silicon JASON RYAN, JASON CAMPBELL, THOMAS PRIBICKO, PATRICK LENAHAN, Penn State, JOHN CONLEY, Sharp Labs, WILMAN TSAI, Intel Corp. — We have investigated paramagnetic defects in hafnium oxide films prepared under a fairly wide variety of processing parameters; most films were deposited with atomic layer deposition. Deposition took place on both hydrogen terminated silicon and on silicon substrates upon which a thin chemical oxide had previously been grown. In all samples, we observe Si/dielectric interface defects similar to the Si/SiO_2 interface P_b centers. However, we note differences between the g tensors of defects observed in hydrogen terminated silicon substrate samples and those observed on the thin chemical oxide/silicon substrate samples. In hydrogen terminated substrate samples we consistently observe shifts in the g perpendicular component of the g tensor toward high values than those found in Si/SiO_2 structures. This is not necessarily the case in hafnium oxides films deposited upon very thin SiO_2 films on silicon. We also observe several paramagnetic centers in the dielectric themselves. As previously reported, we have observed a likely O_2^- center. In addition, in some samples we observe a narrow ESR spectra with zero crossing g values very close to that of the free-electron g = 2.001 to 2.003. The density of these paramagnetic defects are strongly processing dependent. We speculate that these centers are within the dielectric, but very near the silicon substrate, and likely involve an unpaired electron on a silicon atom in the oxide. Work at Penn State was supported by the Semiconductor Research Corporation through Intel Corporation Funding.

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