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Synthesis and Physical Characterization of thin silicondioxide (SiO_2) layers with very high densities of E' centers K. AMBAL, A. PAYNE, D.P. WATERS, C. WILLIAMS, C. BOEHME, Univ. of Utah — E' centers are paramagnetic (s=1/2) electronic states which are due to silicon dangling bonds in a-SiO_2 [1]. E' centers are able to trap electric charge, which can be detrimental to the performance of silicon based electronic devices. Therefore, most previous studies of E' centers have focused on a-SiO_2 layers with low E' center densities and material preparation techniques that allow to minimize it. Here, we present a study aiming at the opposite, the question of how E' center densities in a-SiO_2 can be maximized and whether E' centers in higher densities still exhibit similar spin dynamics (relaxation rates) in comparison to SiO_2 with low E' center densities. This study has been motivated by the need for a dielectric material containing very high spin densities as needed for single spin detection techniques. It is shown in this study that E' centers can be created at densities above $\sim 10^{19}$ cm^{-3} through exposure of a thin thermal oxide sample to an rf plasma containing Ar at low pressure. Most of the E' centers were found within 20 nm to 30 nm of the SiO_2 surface. While the high E' center densities can be annealed completely at 300 °C, they are very stable at room temperature. Spin relaxation time measurements show that T_2 of high density E' centers does not strongly depend on temperature and T_1 is $\sim 600\mu$s at 5K with an increase towards lower densities [1]. At room temperatureT_1 is $\sim 160\mu$s, which agrees well with values found in literature for E' centers at low densities [2].

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