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Interface Sensitive Measurement of High k - silicon dioxide silicon system using Optical Second Harmonic Generation
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The properties of the interface layer play a key role in the properties of transistor gate dielectric stacks. This has resulted in a renewed emphasis being placed on physical interfacial characterization. Electrical measurements such as capacitance – voltage have always been sensitive to the number of interface trapping states. The sub 5 nm thickness of high κ - silicon dioxide films on silicon challenges all characterization methods. Traditional characterization methods such as scanning transmission electron microscopy have seen rapid advances in capability as the first aberration corrected microscopes become available. Pennycook recently observed single Hf atoms in the silicon dioxide interfacial layer.(1) Less widely used methods also show considerable promise. Optical second harmonic generation has been used to measure interfacial states in the silicon dioxide – silicon interface.(2) In this paper, we discuss our first SHG measurements of the High κ - silicon dioxide – silicon system. Comparisons between the responses of Hf O₂ and HfO_xSi_y before and after annealing show the effect of silicate decomposition after annealing. Time dependent optical SHG is believed to be sensitive to trap density, and we again show our first results. When possible, we compare SHG to electrical measurements.

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