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Nano-laminate vs. Direct Deposition of High Permittivity Gadolinium Scandate on Silicon by High Pressure Sputtering

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In this work we use the high pressure sputtering technique to deposit the high permittivity dielectric gadolinium scandate on silicon substrates. This nonconventional deposition technique prevents substrate damage and allows for growth of ternary compounds with controlled composition. Two different approaches were assessed: the first one consists in depositing the material directly from a stoichiometric $GdScO_3$ target; in the second one, we anneal a nano-laminate of <0.5 nm thick Gd_2O_3 and Sc_2O_3 films in order to control the composition of the scandate. Metal-insulator-semiconductor capacitors were fabricated with platinum gates for electrical characterization. Accordingly, we grow a Gd-rich $Gd_{2-x}Sc_xO_3$ film that, in spite of higher leakage currents, presents a better effective relative permittivity of 21 and lower density of defects.

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