**In Situ** Surface cleaning on a Ge Substrate using TMA and MgCp\(_2\) for HfO\(_2\)-based Gate Oxides

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Supporting information 1 Poole-Frenkel conduction by doping temperature-dependent Jg measurement, (a) TMA 120s cleaning and (b) MgCp\(_2\) 120s cleaning one. The fitted line slope of Ln(J/E) versus 1000/T yields the trap energy levels from the conduction band of HfO\(_2\), the effective values of which were determined to be 0.64 and 0.53 eV for 120s TMA- and MgCp\(_2\)-cleaned samples, respectively. This indicates that the trap energy levels of the 120s MgCp\(_2\)-cleaned sample are slightly lower than those of the 120s TMA-cleaned sample.
Supporting information 2 I-V curves of MOS capacitors with (a) TMA 120s cleaning and (b) MgCp₂ 120s cleaning measured at 25, 50, and 75 °C. At high temperatures, since the trap energy level of the 120s MgCp₂-cleaned sample is closer to the conduction band minimum, the leakage currents of the 120s MgCp₂-cleaned sample are larger than those of TMA.

Notes and references

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