Thin capacitor breakdown voltage

What is the breakdown voltage of MIM capacitor?
The breakdown voltage of MIM capacitor with capacitor dielectric 60+/-3 nm of ALD HfO2, ALD Al2O3, and PECVD Si3N4 as a function of capacitor area. Figure 8 shows the extracted quality factor of the MIM capacitor at various frequencies, when these three films were used as capacitor dielectric on GaAs HBT wafers.

What determines the rated voltage of a capacitor?
The rated voltage depends on the material and thickness of the dielectric,the spacing between the plates,and design factors like insulation margins. Manufacturers determine the voltage rating through accelerated aging teststo ensure the capacitor will operate reliably below specified voltages and temperatures.

What causes the breakdown of capacitances with thickness of 1m to 15m?
Simulations suggest that the impact-ionization generationis the dominant mechanism of the breakdown in capacitances with thicknesses from 1 u m to 15 u m. The effect of the 2D geometry has been analyzed nicely explaining the measured characteristics.

What happens if a capacitor exceeds rated voltage?
Capacitors have a maximum voltage,called the working voltage or rated voltage,which specifies the maximum potential difference that can be applied safely across the terminals. Exceeding the rated voltage causes the dielectric material between the capacitor plates to break down,resulting in permanent damage to the capacitor.

Which capacitor has the lowest leakage current density?
As can be seen,the capacitor with 59 nm PECVD Si3N4resulted in the lowest leakage current density,while that with HfO2 resulted in the highest leakage current density. Furthermore,as the temperature was increased,the leakage current density increase was higher for the ALD HfO2 and Al2O3 films.

Why do MIM capacitors need to be scaled down?
In addition to capacitance density performance,the electrical performance and reliability of MIM capacitors are also matters of concern as device is scaled down. As we all know,it is the most effective way to increase breakdown voltageby directly increasing SiNx dielectric layer thickness.

High-voltage dielectric breakdown of thick amorphous silicon dioxide capacitors for galvanic insulation is experimentally investigated and analyzed through numerical ...

We present a systematic study of the dependence of breakdown voltages on oxide thickness d in Al-AlOx-Al thin-film capacitor structures. For sufficiently thin dielectrics, we find that a significant portion of the measured breakdown potentialVb ...

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In addition to high capacitance density, the MIM capacitor in GaAs technology typically is also required to have high breakdown voltage, low leakage current, and high quality factor. The ...

Silicon dioxide (SiO2) thin film insulators have a breakdown voltage of ap- proximately 10 MV/cm and a dielectric constant of approximately 4, making a quality factor of 40MV/cm.

The dielectric breakdown voltage (BV) and time dependent dielectric breakdown (TDDB) are the most important concerns for device reliability. In this study, the silicon nitride (SiNx) used as metal-insulator-metal (MIM) capacitor dielectric was successfully prepared by a dual-frequency plasma enhanced chemical vapor deposition (PECVD) method ...

Very thin layers of dielectric are used in capacitors, and hence, absolute breakdown voltage of capacitors is thus limited. In general electronic applications, the typical ratings for capacitors used are ranging from a few V to 1 kV.

Embedded capacitor technology in thin film form offers a promising solution to these limitations. A design space with capacitance density and breakdown voltage as performance properties, with material dielectric constant and film thickness as parameters has been explored, focusing on tantalum pentoxide (Ta/sub 2/O/sub 5/) as the dielectric ...

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