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Sponsoring Unit: FIAP
Chair: Nadine Gergel-Hackett, Mary Baldwin Coll

Abstract: P59.00008 : Outstanding dielectric properties of ultra-thin CaF_2 dielectric films

4:24 PM–4:36 PM Live

← Abstract →

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The integration of two-dimensional (2D) materials into microelectronic devices usually suffers from a problematic 2D/3D interface due to the dangling bonds at the 3D dielectric surfaces. One probable solution is to introduce 2D layered dielectrics, such as hexagonal boron nitride (h-BN), to form a clean Van der Waals structure. However, most of the reported h-BN based microelectronic devices are fabricated by non-scalable mechanical exfoliation method. When h-BN is synthesized by a scalable method, chemical vapor deposition (CVD), it shows a large amount of amorphous defects, reducing its dielectric strength. Compared to h-BN, calcium fluoride (CaF_2) has a higher dielectric constant and can be deposited by molecular beam epitaxy (MBE) at 250 °C. Furthermore, the surface of CaF_2 (111) is terminated by fluorine atoms, which results in a Van der Waals interface between the 2D material and the CaF_2 (111). In our work, we found that ultra-thin CaF_2 films synthesized by MBE show high homogeneity and low leakage currents. Moreover, CaF_2 films show a strong dielectric strength (~ 27.8 ± 1.7 MV/cm), much higher than that of SiO_2 (~ 20.3 ± 0.9 MV/cm). These outstanding electrical performances are related to the low amount of defects in the cubic ionic crystalline structure of CaF_2.