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Reliability Characteristics of Diamond-Like Carbon as Gate Insulator for Metal–Insulator–Semiconductor Application

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This study presents the reliability of diamond-like carbon (DLC) ultrathin films fabricated by DC magnetron sputtering as the gate dielectric layer in metal–insulator–semiconductor (MIS) devices. Stress-induced leakage current (SILC) and time-dependent dielectric breakdown (TDDB) measurements were performed to determine the reliability of the devices. The MIS device with DLC film deposited at 1100-V bias exhibited little variation of SILC under different constant voltage stress times and had a long TDDB lifetime. The results indicate excellent reliability of DLC films used as gate dielectrics. Moreover, several soft breakdown events occurred during TDDB measuring. An extended percolation model was adopted for explanation of the current versus time characteristics.

Keywords: diamond-like carbon, metal–insulator–semiconductor, gate dielectric, stress-induced leakage current, time-dependent dielectric breakdown, reliability, extended percolation model.