Investigation on electrical properties of RF sputtered deposited BCN thin films

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The ever increasing advancements in semiconductor technology and continuous scaling of CMOS devices mandate the need for new dielectric materials with low-k values. The interconnect delay can be reduced not only by the resistance of the conductor but also by decreasing the capacitance of dielectric layer. Also cross-talk is a major issue faced by semiconductor industry due to high value of k of the inter-dielectric layer (IDL) in a multilevel wiring scheme in Si ultra large scale integrated circuit (ULSI) devices. In order to reduce the time delay, it is necessary to introduce a wiring metal with low resistivity and a high quality insulating film with a low dielectric constant which leads to a reduction of the wiring capacitance.

Boron carbon nitride (BCN) films are prepared by reactive magnetron sputtering from a B_4C target and deposited to make metal-insulator-metal (MIM) sandwich structures using aluminum as the top and bottom electrodes. BCN films are deposited at various N_2/Ar gas flow ratios, substrate temperatures and process pressures. The electrical characterization of the MIM devices includes capacitance vs. voltage (C-V), current vs voltage, and breakdown voltage characteristics. The above characterizations are performed as a function of deposition parameters.