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Plasma Process to Simultaneously Clean ILD and CMP Cu Surfaces¹ XIN LIU, SANDEEP GILL, FU TANG, Arizona State University, SEAN KING, Intel Corp., R.J. NEMANICH, Arizona State University — Low-k inter-layer dielectrics (ILD) with copper interconnects display advantages for reducing energy consumption in silicon technology. However, the processing induced degradation of the ILD low-k properties has become a challenge. In this work, we have employed remote N₂/H₂ plasma processes to simultaneously clean both low-k ILD (k=2.5) and chemical-mechanical polished (CMP) Cu surfaces. FTIR and C-V results indicate that N₂ plasma cleaning processes show low carbon abstraction as well as a relatively small increase in the dielectric constant (k=2.6). A carboxamide layer is formed which apparently inhibits further etching. In contrast, the k value increases to 3.5 after an H₂ plasma treatment. For the CMP-Cu surfaces, an N₂/H₂ plasma process at 380C effectively removes the oxide and carbon contamination. In addition, the affects of plasma-induced UV light has been studied, and the results indicate enhanced carbon depletion in the ILD. Degradation of the low-k properties is attributed to carbon abstraction which is enhanced by the plasma induced UV and hydrophilic character. The results establish a range of N₂/H₂ plasma processes for simultaneous cleaning of CMP Cu and low-k ILD surfaces.

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