Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Plasma damage and restoration of a spin-on organic ultra low-k material (k=2.3) MIKOLAJ LUKASZEWICZ, Wroclaw University, JEAN-FRANCOIS DE MARNEFFE, CHRISTOPHER J. WILSON, LIPING ZHANG, HSIN-YING PENG, PATRICK VERDONCK, MIKHAIL BAKLANOV, Imec v.z.w.
— As interconnect dielectrics, spin-on polymers might offer some advantages over OSG materials. In particular, a lower k-value is possible with less porosity, smaller pore size. They also have greater resistance to plasma damage due to their mono-component nature. However, some chemical modifications during the plasma exposure cannot be avoided. In this work, we study the changes caused by a N_2-H_2-C_2H_4 CCP discharge used for damascene patterning, on a spin-on k=2.3 organic low-k material. It is shown that this plasma forms amine and ester groups, leading to hydrophilization and k-value degradation. Several restoration treatments are studied on blanket wafers, trying to restore the chemical composition, minimize the k-value and hydrophilization. Those treatments include exposure to in-situ He-H_2 discharge, high temperature He-H_2 afterglow and combinations thereof, low- and high-temperature VUV treatments. It is found that the best k-value gain is around 50%, and the most promising repair treatment results from the short exposure to a combination of low temperature in-situ He-H_2 discharge and high temperature He-H_2 afterglow. Applying such restoration process to an array of 30nm trenches, the integrated k-value showed a gain of 13% in RC constant, indicating efficient restoration to pristine k-value, although the chemical composition was not completely restored in all evaluated conditions.

Jean-Francois de Marneffe
Imec v.z.w.

Date submitted: 15 Jun 2012 Electronic form version 1.4