A Novel Approach to Reduce Via Corner Faceting in the Via-First, No Middle Stop Layer Dual Damascene Trench Etch

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The effects of process parameters in a C_2F_6/CO magnetically enhanced RIE plasma on the ratio of oxide etch depth between vertical and lateral direction at via hole in trench pattern for dual damascene (DD) are reported. Operating the C_2F_6 plasma at high pressure (>100 mTorr) results in highly anisotropic oxide etching. By controlling the formation rate of depositing polymer precursors, isotropic etching of the DD structure is lessened. Spectroscopic data suggests a correlation between the polymer deposition rate, high vertical:lateral etch loss ratio, and reduced micro trenching. An explanation for the results is proposed.

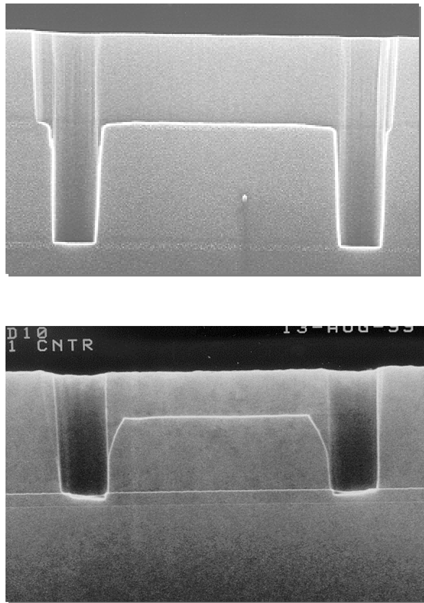

Fig. 1) Comparison of two different DD trench. (a) with mid stop layer, (b) no stop layer

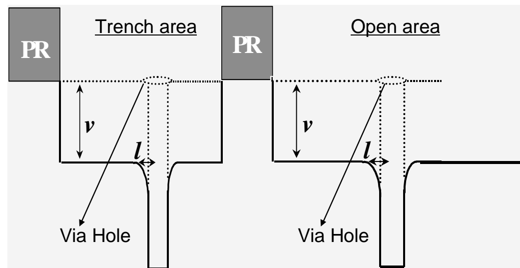

Fig. 2) Schematic view of the ratio between lateral and vertical loss at via hole during trench etching.

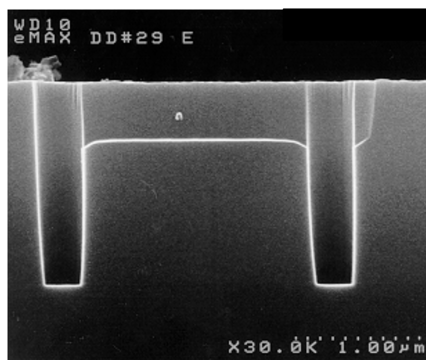

Fig. 3) Variation of polymer deposition ratio between top surface and inside via hole with chamber pressure.

Thickness of polymer deposited is measured for both upper and bottom of the wall in via hole and then divided by thickness of polymer on the top surface of wafer, respectively.

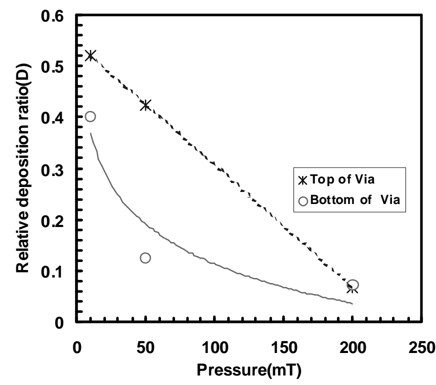

Fig. 4) No mid stop layered DD trench etched by C2F6/CO chemistry