High Productivity 300mm HDP-CVD for Next-Generation Gap Fill Processes

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Abstract

CVD gap-fill for shallow trench isolation, pre-metal and inter-metal dielectrics has constantly been challenged with shrinking geometry at every technology node. While IMD gap-fill is being replaced with the damascene approach, STI and PMD structures still need a gap-fill solution. High-density plasma (HDP) sources have stretched the technology capability to fill gaps from 0.25µm wide with aspect ratios of 2:1 down to gaps of 0.15µm and aspect ratios of 3.5:1. Next generation gap-fill will be even stiffer and will require filling of <0.07 µm trenches having aspect ratio of 6:1.

In this paper, we will review studies of processes that incorporate a modified plasma source, new gas chemistry, a more efficient remote plasma clean system, controlled chamber cooling, and optimized power and pressure. We demonstrate processes for shallow trench isolation, pre-metal dielectric, and inter-metal dielectric gap filling capable of meeting the 0.10-µm technology node requirements. This technological extension has been achieved while maintaining high productivity and low cost of operation.

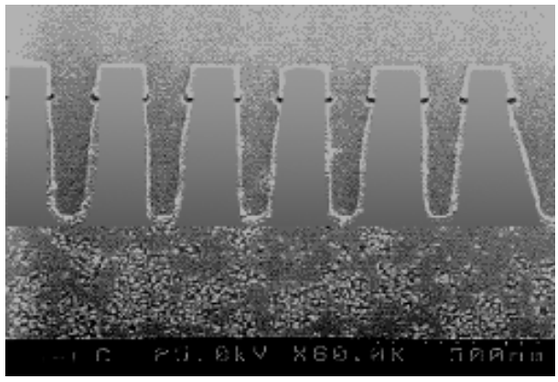

Figure1: 300mm STI SEM photography showing gap fill at 0.08 micron