SYNTHESIS OF A FUNCTIONALLY GRADED PAD FOR CHEMICAL MECHANICAL PLANARIZATION

ABSTRACT

The material removal rate, defectivity, erosion, and dishing and the effective planarization length of a CMP process depend on the local tribology (hardness, compliances) and physical properties (pore size & density, asperities) of the pad material. Graded pads exhibit spatial modulation in various material/tribological properties customized to planarize:(i) Dissimilar material stacks such as metal/barrier or oxide/nitride [STI] with minimum dishing, erosion, over polish and nanotopography.(ii) Specialized materials (low-k, strain silicon and SOI) with minimum erosion and slurry selectivity. (iii) Devices with complex design and architecture (system-on a-chip and vertical gate) with varying pattern density and chip sizes. Several types of grading described here include annular, island, step and continuous grading. The pad grading design for a CMP process for a particular slurry chemistry and wafer sweep over the pad is based on local pad material (hardness, compliances, pore size and asperities) properties. Such functionally graded polymeric pads are expected to have significant impact in planarizing scaled (sub-100 nm) silicon ICs, disk drive, micromachine (MEMs) and nanocomposite substrates.

(No suitable figure)