A theoretical model incorporating both the nano-scale material removal and wafer global uniformity during planarization process

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A theoretical model incorporating both the nano-scale material removal and wafer global uniformity during planarization process

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Abstract

In the ultra large-scale integration process, as chemical mechanical polishing (CMP) is developing to higher precision, nano level planarity and sub-nano level roughness of wafer surfaces become key problems to be overcome. In this work, a theoretical model for local and total material removal was proposed based on the particle sliding trajectories and chemical-mechanical synergy, and the material removal distribution on wafer surface were analyzed. Furthermore, the chemical-mechanical mechanism was studied and synergy maps constructed. It is found that the passivation-wear and additive-synergistic effects dominate the material removal during CMP. This study establishes a correlation mechanism between the nano material removal and global uniformity of wafer surfaces, which provides theoretical and experimental framework for optimizing the slurry and the process parameters.

Keywords: Chemical mechanical polishing; Wear modelling; Corrosion-wear;

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