**Title:**

Polishing behavior of PS/SiO2 Core-Shell nanoparticles with different shell thickness on fused silica Chemical Mechanical Polishing

**Abstract:**

The core-shell PS/SiO2 composite nanoparticles as abrasives with different shell thickness was researched in fused silica Chemical mechanical polishing (CMP) for the first time. The polystyrene nanoparticles were prepared by using emulsifier-free polymerization method first, then the PS/SiO2 with different shell thickness were synthesized by modified Stöber method. The morphologies of PS/SiO2 monodisperse nanospheres were characterized with scanning electron microscopy (SEM). The elastic moduli of single nanoparticle was measured by atomic force microscopy (AFM). The CMP results indicated that the material remove rate (MRR) has been obviously improved with as-prepared nanospheres (21-31 nm/min). There was a trend that MRR is rising when the shell thickness is between 200 and 50nm and then falling when the shell thickness is 35nm. Based on the small deformation theory, the finite element analysis was used to simulate the indentation depth and radius of the contact area between the individual particle and the wafer. Then a reasonable explanation for the experimental results was put forward. This research pave a way for realizing the optimization of CMP and material precise removal in the future.