Microstructure and Nanoelectronic Device/Patterning Applications of Organosilicate Polymers

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Organosilicate polymers such as poly(hydridosilsesquioxane) (PHSQ) and poly (methylsilsesquioxane) (PMSQ) have become of serious interest due to their applications as low-dielectric materials for interconnects and e-beam resist materials for nanopatterning. However, they have serious shortcomings in key properties, due to the poor understanding of their structure-property relationships. We have delineated the key structural characteristics which are responsible for the critical properties of organosilicate polymers and consequently developed novel organosilicate polymers which exhibit significant improvements over the previously available materials. They allow the preparation of ultralow-dielectric ($k < 2$) films with satisfactory mechanical and nanoporous morphology characteristics, and also improved e-beam resist materials better than PHSQ for patterning nanoelectronic devices with critical dimensions < 20 nm.