Nano-templated Silsesquioxanes for Electrical/Optical Applications

Sue Ann Bidstrup Allen, Jaseem Abdallah, Paul A. Kohl
School of Chemical Engineering, Georgia Tech, Atlanta, GA 30332-0100

The minimum feature size of integrated circuits will soon break through the 100 nm barrier. Unlike transistors, traditional metallic interconnects become slower and have degraded performance as their size shrinks. This looming crisis for microelectronic devices demands that new interconnect technologies be created. One potential solution to the interconnect bottleneck involves the use of optical interconnects because they posses the speed and bandwidth to meet future IC needs. However, optical waveguides have significant drawbacks. Optical communication derived from telecom uses (i) do not have necessary components for chip-scale implementation, (ii) use materials that are extremely disruptive to integrate into ICs, and (iii) are cost prohibitive.

This paper focuses on materials development for optoelectronic systems to overcome the limitations described above. Novel phenomena in nanostructured optical and dielectric materials are explored to develop new fabrication technology for producing direct-write waveguides. By incorporating photodefinable sacrificial polymers templated in a spin-coat silsesquioxane material, the waveguide core and side cladding may be patterned simultaneously through the selective decomposition of sacrificial polymers creating porosity in the desired cladding areas. The decomposition of the porogen results in a porous matrix, thereby decreasing the refractive index of the regions where the polymer is selectively decomposed.