272b Microfabrication of Mesoporous Silica Films for Mems Applications

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Chip-scale devices are of great interest mainly due to their portability and novel functionality.1 One of the key components in such devices is functional porous film nanostructure. Despite recent development in silicon-based microelectromechanical systems (MEMS) technology, with current top-down micromachining it is still a technological challenge to fabricate such porous functional nanostructure in cost-effective ways. Self-assembled mesoporous silica films can be an alternative to creating such nanostructure in a simple and controlled manner since they can be easily coated using conventional coating techniques2 (for instance, spin-coating and dip-coating), readily functionalized with functional organic groups, and are compatible with current silicon microfabrication technology.3 Self-assembled mesoporous silica materials (in the form of power or film) have drawn a great deal of research interest over the last decade.4,5 Their unique pore structures of nanometer dimension enable them to find applications in separation, catalysis, encapsulation, chemical/biological sensing, low-dielectric coatings, and optical thin films. In order to use the mesoporous films for MEMS applications as novel nanostructures, one has to solve several challenging problems. Such problems include: 1) to deposit continuous films of thickness of several micrometers in a facile way and 2) to fabricate self-standing films by microfabrication techniques for certain MEMS applications such as micro fuel cells. In this talk, we will introduce a new way to prepare continuous mesoporous films of 2-3 micrometer thick using a lamp-based rapid thermal processing technique. We will also talk about the preparation of self-supporting mesoporous films on a silicon wafer using microfabrication techniques. The characterization of the microstructures of the mesoporous films will be presented. The functionality of the self-supporting mesoporous films will be demonstrated by fabricating direct formic acid micro fuel cells and measuring performance.

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