P-4-01

Studies on Fabrication of SiCN Microstructures for High-Temperature MEMS Applications

Dong-Woo Jin[a], Hyung-Soon Woo[a], Gwiy-Sang Ghung[b], Gue-Hyun Kim[a]

[a]Division of Applied Bio Engineering, Dongseo University, Busan 617-716, South Korea
[b]School of Electrical Engineering, Ulsan University, Ulsan 680-749, Korea

In recent years, high-temperature MEMS have attracted considerable attention due to its many potential applications, such as optical MEMS for high power laser applications and microcombustors for MEMS power sources. In general, Si-MEMS have two major problems: leakage current at pn junction at high-temperature and complex etching or deposition process. On the other hand, polysilazane-derived SiCN (silicon carbonitride) is an excellent candidate for high-temperature MEMS because of its excellent thermal stability. Also the fabrication process of SiCN-MEMS is much simpler and cheaper than that of Si-MEMS.

This presentation describes a novel fabrication process of high-temperature MEMS based on liquid-polysilazane-derived SiCN ceramic microstructures. First, PDMS (polydimethylsiloxane) molds were fabricated on SU-8 photoresist using standard UV-photolithographic process. Liquid polysilazane and photoinitiator (2,2-dimethoxy-2-phenyl acetophenone) were injected into the PDMS mold. The liquid-phase polysilazane is converted into solid-phase polysilazane by UV exposure. And then, solid-phase polysilazane structure is cross-linked using HIP (hot isostatic press) at 400°C, 205 bar. Thermal decomposition transformed the polymer to a ceramic capable of withstanding over 1400°C. In addition, physical and electric properties of SiCN microstructure prepared with different pyrolysis condition were studied. The SiCN microstructures, which are pyrolyzed at HIP, have the greatest insulation resistance and break down voltage characteristics than other SiCN samples or Si substrate. Finally, optimum pyrolysis process condition was determined for SiCN microstructure fabrication. Consequently, the fabricated SiCN ceramic microstructures may be applied for high-temperature MEMS applications, such as heat exchanger and combustion chamber.