Public Abstract

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Graduation Term:FS 2011

Department:Mechanical & Aerospace Engineering

Degree:PhD

Title:FABRICATION AND CHARACTERIZATION OF HEAT FLUX SENSOR USING POLYMER DERIVED CERAMICS

MEMS sensor for high temperature environment is demanded in many applications such as turbine engine, nuclear reactor. However, silicon, source material for MEMS, has poor high temperature properties, which makes ones think about the ceramic as a source material for high temperature MEMS devices. In this study, a free standing Resistance Temperature Detector (RTD) sensor made from Polymer Derived Ceramics (PDCs) for high temperature application (above 1000 Celcius) is fabricated. A newly developed fabrication method to polymerize the precursor into RTD patterns is employed, which is called direct contact polymerization method.

In addition to the free standing RTD sensor, RTD sensor arrays are also fabricated on sapphire and quartz substrate. To overcome about 35% of shrinkage rate of polysilazane polymer, Active Filler Controlled Pyrolysis (AFCP) method has been employed. With the fillers of Al powder and TiB₂, the shrinkage rate of our pattern after pyrolyzing at 800 Celcius is reduced to about 3-5%, which makes the patterning of an RTD array on substrate possible. These RTD sensors on quartz and sapphire wafers are connected to the data acquisition system to find the relation between the temperature and resistance.

Furthermore, various characterization studies are conducted on fabricated RTD samples such as SEM/EDS, XRD for elemental analysis and crystallinity tests. For use as an RTD sensor, resistance of the RTD sensor is related to temperature. From the resulting PDC RTD sensors, a Heat Flux Sensor (HFS) for high temperature application is fabricated and investigated.