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Physical and Dielectric Properties of Chemically-Driven Zero Shrinkage LTCC

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The shrinkage variations create serious problems such as a mismatch of the stacking via pattern and a high device failure rate in LTCC (Low Temperature Co-fired Ceramics) production. There are several approaches to zero x-y shrinkage such as release tape technique and self-constrained tape technique. However, release tape technique requires additional procedure to eliminate the release tape through mechanical scrubbing. Self-constrained tape technique may cause delamination or macro-cracks due to poor mechanical integrity between the internal constraining tapes. This work demonstrates a new approach of producing zero x-y shrinkage without any additional experimental procedure such as scrubbing or secondary constraining layers. This new approach is based on new LTCC composition consisting of novel glass and ceramic filler. Physical and dielectric properties changed depending on glass and filler composition, which determine the chemical reactivity and densification behavior. Carefully-designed LTCC materials successfully demonstrated a zero x-y shrinkage under the common firing condition such as 850°C. Dielectric constants of 5-11 and loss tangents of < 0.01 at 1MHz were obtained over different combinations between LTCC constituents.

Keywords: LTCC, zero shrinkage

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Dry etching of Polymethyl methacrylate (PMMA) in capacitively coupled SF_6, SF_6/Ar and SF_6/CH_4 plasmas.

박연현, 주영우, 김재권, 노호섭, 이진희, 이제원†, 조관식, 송한정

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Polymethyl methacrylate (PMMA) is considered about new substrate material for MEMS and Display due to its light weight, high transparency and low material cost. We studied dry etching of Polymethyl methacrylate (PMMA) in capacitively coupled SF_6, SF_6/Ar and SF_6/CH_4 plasmas. We used mechanical pumping-based capacitively coupled plasmas and measured the etch rate, selectivity and RMS roughness. The etch parameters were RIE chuck power and % gas composition. After etching the results were measured by surface profiler, Optical Emission Spectroscopy and FE-SEM .

In this experiment, we knew the effect of fluorine in Polymethyl methacrylate (PMMA) substrate. At the SF_6, SF_6/Ar and SF_6/CH_4 plasmas, etch rate of the PMMA was linearly increased from 25W to 150W. Etch rate of the PMMA in the mixed SF_6/Ar was better than pure SF_6 gas. RMS roughness was somewhat rough than before etching. We also discussed about OES data.

Keywords: Plasma etching, Polymer etching, Polymethyl methacrylate (PMMA)