SUMMARY OF Ph.D. DISSERTATION

School	Student Identification Number	SURNAME, First name
Integrated Design Engineering		CHAZONO, Hirokazu

Title

Structure-Property Relationship in $BaTiO_3$-Based Dielectrics for Multilayer Ceramic Capacitor

Abstract

Nowadays, the downsizing with large capacitance for multi-layer ceramic capacitor with Ni internal electrode (Ni-MLCC) is required. Therefore, understanding the structure-property relationship in $BaTiO_3$ (BT)-based dielectrics for Ni-MLCC is important since the electric field for 1 dielectric layer is increasing. The aim of this paper is to better understand the relationship between the microstructure and electrical properties, especially dc electrical degradation.

Chapter 1 summarizes the background and previous studies, and the aim of this study.

Chapter 2 describes the experimental procedures.

Chapter 3 describes the effect of chemical composition on the temperature characteristics of capacitance (TCC) and the stability of microstructure for BT-Nb_2O_5-Co_3O_4 system through the detailed studies of the microstructure observation, and sintering and diffusion behaviors. The role of Nb_2O_5 was found to be important to obtain the stable “core-shell” structure.

Chapter 4 describes the effect of rare earth doping on the microstructure and electrical properties. The difference in the effect of doped rare earth species was supposed to be corresponding to the difference in the ionic radius. Samples with almost identical microstructure but different chemical composition, containing Dy_2O_3 or Ho_2O_3 , were successfully prepared and the comparison of electrical properties for these two samples revealed that the microstructure was more dominant to the electrical properties than the chemical composition as long as these two samples concerned.

Chapter 5 describes the dc electrical degradation behavior for Ni-MLCC with thin active dielectric layers. The equivalent electrical network was obtained to be 4-RC by the frequency domain of impedance measured at elevated temperatures above 240°C in the range from 2mHz to 5MHz. Moreover, these 4 RC components were correlated to the microstructures, i.e., the core, shell, grain boundary (G.B.), and the dielectric/internal electrode interface. The model of dc electrical degradation for Ni-MLCC with thin active dielectric layers was proposed.

Chapter 6 summarizes the results of this study.