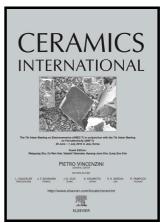
### Author's Accepted Manuscript

 $\text{Co}_2\text{O}_3$  substitution effects on the structure and microwave dielectric properties of low-firing  $(\text{Zn}_{0.9}\text{Mg}_{0.1})\text{TiO}_3$  ceramics

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#### **ACCEPTED MANUSCRIPT**

# Co<sub>2</sub>O<sub>3</sub> substitution effects on the structure and microwave

dielectric properties of low-firing (Zn<sub>0.9</sub>Mg<sub>0.1</sub>)TiO<sub>3</sub> ceramics

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#### **Abstract**

Low-firing  $(Zn_{0.9}Mg_{0.1})_{1-x}Co_xTiO_3$  (x = 0.02 ~ 0.10) (ZMC<sub>x</sub>T) microwave dielectric ceramics with high temperature stability were synthesized *via* conventional solid-state reaction. The influences of  $Co_2O_3$  substitution on the phase composition, microstructure and microwave dielectric properties of ZMC<sub>x</sub>T ceramics were discussed. Rietveld refinement results show the coexistence of ZnTiO<sub>3</sub> and ZnB<sub>2</sub>O<sub>4</sub> phases at x = 0.02 ~ 0.10.  $(Zn_{0.9}Mg_{0.1})_{1-x}Co_xTiO_3$  ceramic with x = 0.06 (ZMC<sub>0.06</sub>T) obtains the best combination microwave dielectric properties of:  $\varepsilon_r$  = 21.58,  $Q \times f$  = 53,948 GHz,  $\tau_f$  = -54.38 ppm/°C. For expanding its application in LTCC field, 3 wt. % ZnO-B<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> (ZBS) and 9 wt. % TiO<sub>2</sub> was added into ZMC<sub>0.06</sub>T ceramic, great microwave dielectric properties were achieved at 900°C for 4 h:  $\varepsilon_r$  = 26.03,  $Q \times f$  = 34,830 GHz,  $\tau_f$  = -4 ppm/°C, making the composite ceramic a promising candidate for LTCC industry.

Key words: (Zn<sub>0.9</sub>Mg<sub>0.1</sub>)TiO<sub>3</sub>, Co<sub>2</sub>O<sub>3</sub>, ZnO-B<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>, microwave dielectric ceramics, low temperature sintering, LTCC

#### 1. Introduction

High frequency passive components such as microwave dielectric resonators and antenna have been rapidly developed for cellular phones and global positioning systems in the past decades. Low temperature co-fired ceramics (LTCC) technology has been playing a significant role in this field. Requirements for these dielectric components must combine excellent dielectric properties such as a moderate dielectric constant ( $\varepsilon_r$ ), a low dielectric loss of the quality factor ( $Q \times f$ ) and a near-zero temperature coefficient of resonant frequency ( $\tau_f$ ), which allows the components to operate normally under a wide temperature range[1-3].

ZnO-TiO<sub>2</sub> based ceramics have been one favorite research for years because of their excellent microwave dielectric properties. In their phase diagram reported by Yang and Swisher[4], three phases

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