CHAPTER 1

INTRODUCTION

1.1 Introduction

Up to now, barium titanate ($BaTiO_3$: BT) is one of the most important commercial dielectric material used in multi-layer capacitors. Due to its high dielectric constant (5,000-18,000) at temperatures below its Curie temperature, T_c (~130 °C). To support the current trends in the electronic devices which require small sized electronic components with high volumetric efficiency, high reliability and low cost, the modified BT ceramics have widely been studied in the hope to furtherly improve their dielectric properties. It should be noted that complex/mixed perovskite compounds (ABO_3 where A = divalent cation and B = tetravalent cation) formed by substituting suitable single or multi ions at the A- and/or B-sites yield interesting results. Substitutions by divalent to pentavalent cations like in $SrCO_3$, CaO, La_2O_3, ZrO_2, SnO_2 and Nb_2O_5 etc., have lead to many consequences such as higher and broadened dielectric constant peak around T_c, Curie shift, grain growth inhibition and diffuse phase transition [1-5]. These phenomena depended on many factors such as ionic radius, ionic charge, diffusion abilities of ions, grain size distribution, etc. and hence the compound properties should possibly be modified by chemical processing conditions. Another much-needed property of the BT based ceramics is the low sintering temperature in order to reduce the fabrication cost particularly in the manufacture of MLC capacitors. The present research has also included this aspect.

The attempt was done by adding low melting point sintering aids. This is attributed to the fact that, with carefully chosen additives according to the appropriate micro-engineering design, the required microstructure and hence properties of the ceramic can be achieved.

1.2 Objectives

The objectives of this study are thus as following:-

1. To provide a comprehensive knowledge about the process-property relationship in the binary system of $x\text{Ba}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3 - (1\text{-}x)\text{BaTiO}_3$ prepared by mixed oxide method.
2. To identify the optimum composition and synthesizing process for the required ceramic properties.
3. To reduce the sintering temperature of the ceramics in the $x\text{Ba}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3 - (1\text{-}x)\text{BaTiO}_3$ binary system with low melting point additives to below 1000 °C.