CHAPTER 1
INTRODUCTION

1.1 Overview

Recently, dental porcelain ceramics attract much attention from scientists due to their excellent biocompatibility, good thermal compatibility when bonding to metallic framework and reasonable esthetics [1, 2]. They exhibit a great potential as a restorative material for dental applications [1]. However, in general, commercial dental porcelain ceramics contain some amount of leucite crystals sized ~ 5-10 μm causing extensive microcracking around these non-uniformed leucite crystals, which are thought to affect the mechanical and wear properties of these materials [2]. To overcome these problems, several efforts have been made to tailor the leucite morphology, volume fraction and distribution which is thought to affect the mechanical properties of these porcelain ceramics via several heat treatment techniques [3-5]. In connection with this, an effective method called "two-step sintering" has been proposed by Chen & Wang [6] for the preparation of Y_2O_3 ceramics with nano-sized grains. Cattell et al. [4] later reported the successfully produced porcelain-based ceramics with uniform distribution of fine leucite crystals in glassy matrix by tailoring the tempering time via the two-step sintering method. However they could not reach the nanocomposites structure.

In recent year, Sanitnapapong et al. [7] demonstrated that the two-step sintering technique together with 20 wt% ZrO_2 additive has considerable potential for the production of leucite/porcelain ceramic nanocomposites. Besides porcelain, the influence of ZrO_2 additive on crystallization behavior (i.e. hampering crystal growth) in lithium disilicate glass-ceramics was also revealed by Apel et al. [8] Although the study on the formation of leucite crystalline in porcelain based materials has been reported by several researchers [2-4, 9], attentions paid on Zr-modified porcelain-based ceramics are very few. Moreover, to our knowledge a detail investigation considering the potential of zirconia additive with suitable amount for the production of nanocomposites in dental porcelain ceramics has not yet been reported. Thus, the

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aim of this work was to explore the effects of zirconia content on phase formation, densification and microstructure evolution in dental porcelain nanocomposites.

1.2 Research Objectives

To investigate the effects of selected amount of zirconia addition on the leucite crystallization in dental porcelain nanocomposites.

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