CHAPTER 6

CONCLUSIONS AND SUGGESTIONS FOR FURTURE WORKS

6.1 Conclusions

Based on experimental results, it has been demonstrated that the choice of the crystalline additives and processing parameters plays an important role in chemical composition, microstructure and mechanical properties of both Al-Oxides and Ti-Oxides reinforced porcelain systems. The main trends outlined in this work are as follows:

(1) Dental porcelain ceramics with mechanical properties promising to the dental restoration applications can be successfully manufactured from Thailand's raw materials with basic ceramic fabrication process.

(2) High strength dental ceramics in the Al_2O_3-, (Al_2O_3-M_xO_y)-, TiO_2- and (TiO_2-Fe_2O_3)-reinforced porcelain-based systems were successfully fabricated by employing a combination between the crystalline phase reinforcing concept and the ceramic nanocomposite approach.

(3) The mechanical properties of all ceramic nanocomposites are strongly influenced by the presence of reinforced phases and densification mechanism which in turn depend on the processing parameters, i.e. raw material, mixing, homogeneity, shaping method and firing conditions. The observed characteristics of mechanical data (uniaxial flexural strength and fracture toughness) may ultimately be governed by the factors that affect chemical composition, microstructural evolution and

the fabrication techniques.

(4) The crystalline additive (type, size and content) has an important correlation with the resistance to crack propagation. The porcelain ceramic nanocomposites with several crystalline additives presented higher fracture toughness, and a better clinical performance may be expected from them. Based on the microstructural features of these ceramic nanocomposites, it was possible to determine that the main toughening mechanism of these materials is crack deflection around crystalline particles and clusters.

6.2 Suggestions for Future Work

A number of interesting questions remain unanswered concerning the relationships between microstructural evolution and mechanical properties of the ceramic nanocomposites in the Al-Oxides and Ti-Oxides reinforced porcelain systems. Thus, it is anticipated that this could be partly filled by the following suggestions for the further work.

(1) There are necessary to fully understand the role played by every strengthening and toughening mechanism, how these mechanisms can be exploited for future improvements of the properties of dental porcelains and clinical performance of these composite materials.

(2) Additional studies are very crucial to fully understand the mechanism of new phase formation; nanocomposite structures and the role played how these effects can be related to the observed mechanical properties of materials.

(3) The reduction of the processing time, which was found to be advantageous, could lead to strong production economic, but the rapid sintering constitutes a rather innovative point in the field of the matrix composites, since the viscous flow sintering treatments are much longer. So that, the pore will be trapped in the material and related to the decreasing of the strength limiting flaws of material.