

CHAPTER I

INTRODUCTION

Every year a lot of zinc hydrometallurgy waste (Zn-waste) was produced from Padaeng industry Public Co., Ltd. where is located at Tak province, Thailand. Most waste is dumped in landfill sites but there are a limited number of suitable sites. Furthermore this disposal method is generally considered to be environmentally polluted. To solve this problem, recycling Zn-waste to stable materials has been getting attention from previous researches [1,2]. In this study, one of the selections is to transform this waste to more stable, more valuable, and less toxic materials as glass-ceramics.

Glass-ceramics are composed of fine grained polycrystalline materials dispersed in residual glass matrix, which are prepared by the controlled crystallization of parent glasses [3]. There are many of processing methods for glass-ceramic production [4]. However, powder technology and sintering were used to produce glass-ceramics in this study because these methods can use particle boundaries of glass powder as nucleation sites. Glass-ceramics have excellent mechanical properties, low thermal expansion, good thermal shock resistance, and high chemical durability when compared to the parent glasses [5]. Mixing of raw materials subsequently subjected to heat-treatment in order to gain various new crystalline phases and adjust the properties for production of glass-ceramics. The crystalline phases and final properties of the glass-ceramic materials can be controlled by the composition of raw materials and heat treatment method [4].

Raw materials used in this study are not only zinc hydrometallurgy waste but also glass cullet from float glass (clear cullet) and bottles (amber cullet). To study the effects of the cullet on properties of glass-ceramics, different types of cullet were used.

Artificial marble produced in this study was attempted to imitate natural marble for its appearance, physical and mechanical properties. It was one of the alternative ways to add more value to wastes and be able to use for tiles production. When various colors of glass powders were mixed together and fired which resulted in decorative design of marble-like samples, so that creation of artificial marble by sintering glass powders has been getting attention in this work. Artificial marble is one of the applications of these re-used materials.

The aim of this study was to obtain glass-ceramics from utilizing wastes by means of reduction steps in production process and found the optimum condition for crystallization of glass-ceramics. Furthermore, production of artificial marble has been studied as well in order to get a new product from waste and suitable for application as tiles. Characterization of the specimens, i.e. crystalline phase, crystal morphology, physical properties, strength, hardness, thermal expansion, chemical durability, and toxic leaching were investigated.

The purposes of this study are described as follows;

- 1) To convert Zn-waste and glass cullet to glass-ceramics by non-melting process.
- 2) To convert Zn-waste and glass cullet to glass-ceramics by melting and sintering process.
- 3) To study the effects of crystallization times on physical and mechanical properties of glass-ceramics.
- 4) To study possibility for utilization of Zn-waste in the production of artificial marble.