Chapter 1

Introduction

1.1 Motivation

The development of new materials for bone implants and substitutes in man has achieved major importance over the past few decades. Metals, alloys, sintered corundum, and organic polymers (also as composite materials) are used before bioglasses and bioglass-ceramics which give the new possibilities for medical treatment and constitute a new area of research in the medicine.

The primary important properties of bioglasses and bioglass-ceramics are their biocompatibility, i.e., acceptance of the material by the tissue of the human body without irritation, rejection reaction, or toxic effects; and their bioactivity, i.e., the ability to establish firm intergrowths with tissues of the human body. In their bioactivity, bioglasses and bioglass-ceramics are more excellent than the other materials which can be seen in Figure 1-1.

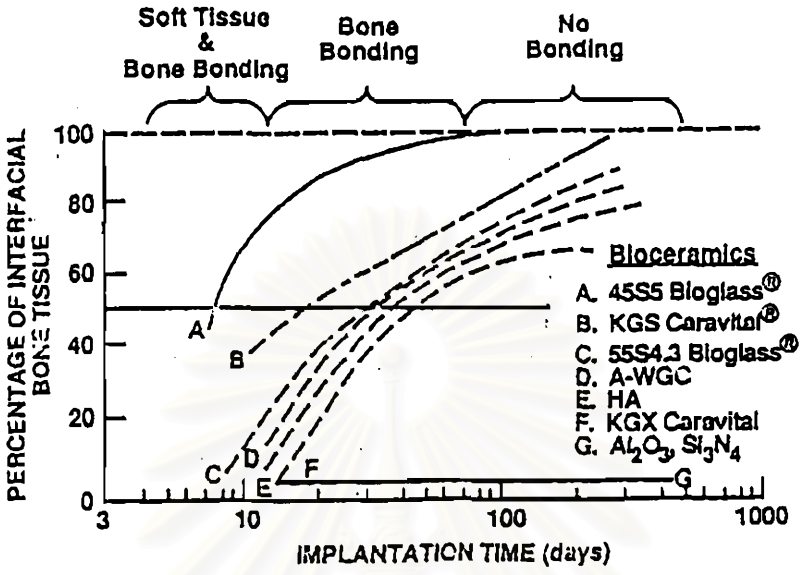

Figure1-1 Bioactivity spectrum for various bioceramic implants as dependence of bone and soft-tissue bonding at an implant interface. [1]

Calcium phosphate glass is one of the materials which is used for medical and dental application as bioglasses or bioglass-ceramics. One of their properties is the high solubility property, which has an influence to the bioactivity; due to phosphate glasses which implant in man can be dissolved easily with the body fluid. An effect of this solubility gives the high concentration around the implant material, then new tissues will be stimulated to create rapidly at an implant interface. The above phenomenon gives an excellent bioactivity for calcium phosphate glasses. Moreover, the main components of calcium phosphate glasses are calcium (Ca) and phosphorus (P) which are similar to the human bone so that they have also an excellent biocompatibility.

Besides this, there is a requirement to form calcium phosphate glass fiber. Because of the excellent properties of glass fibers have already opened a broad field of application. As only one example, the high tensile strength of glass fiber has provided fiber-reinforced plastics as a group of new materials with very low weight for highest mechanical and chemical stresses.

1.2 Objective and Scope

The aims of this work are to produce the calcium phosphate glass fiber by direct-melt method and to study the behavior of calcium phosphate glass such as nucleation, crystallization, and viscosity.

The scope of this research: calcium phosphate starting material was prepared from the reaction of calcium carbonate ($CaCO_3$) and ortho phosphoric acid (H_3PO_4). The prepared starting materials was melted to glass. Both starting material and glass were characterized. The nucleation and crystallization of glass were observed by DTA technique. The viscosity of glass was determined by drop test method. Finally, the calcium phosphate glass fiber was formed by direct-melt method. The outline of this research is illustrated in Figure 1-2

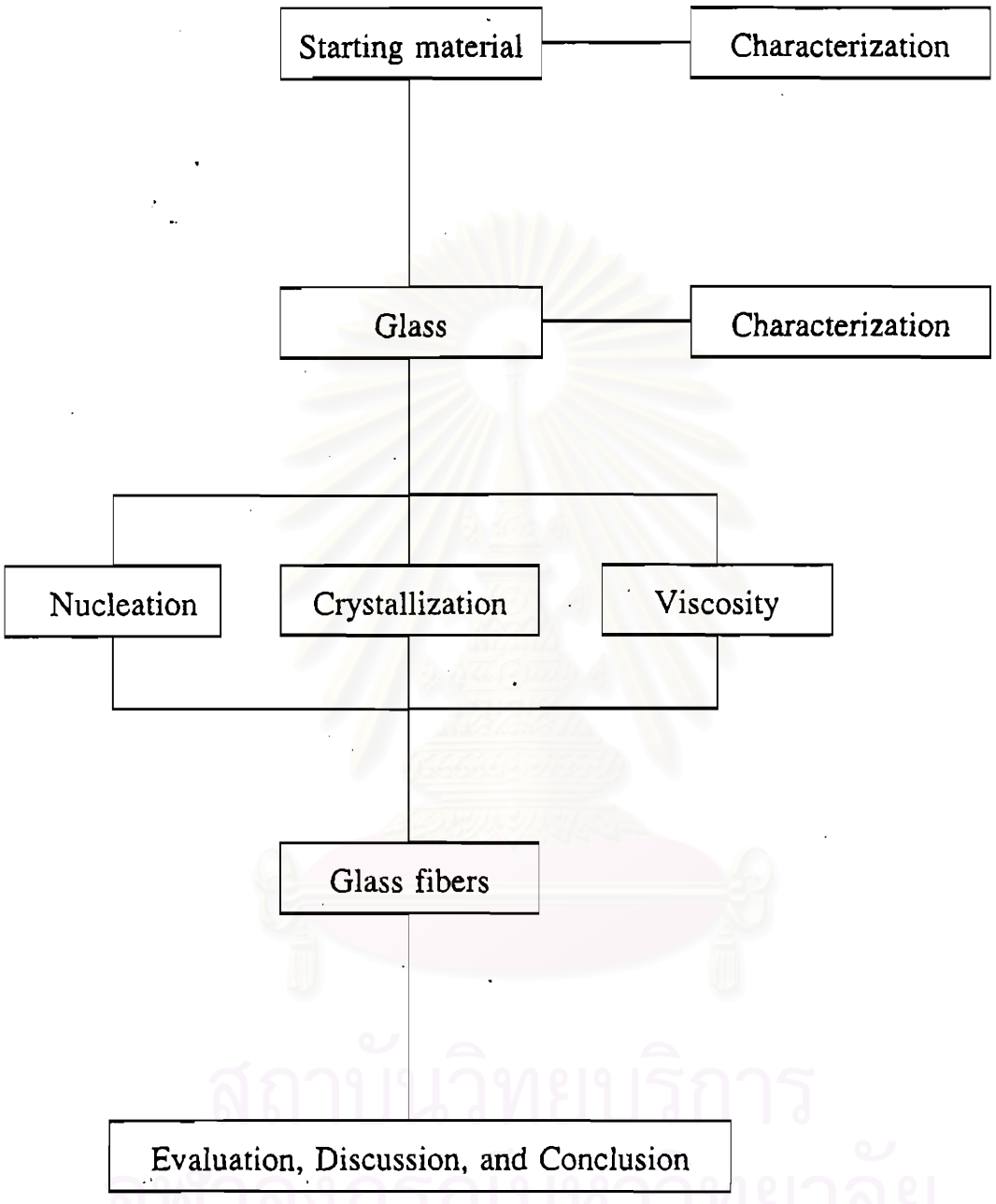

Figure 1-2 Flow chart of the research work.