CHAPTER 2

Literature Survey

In this chapter, literature related with A Knowledge-based System to assist materials selection for plastics injection mold manufacturing are briefly introduced. Because there are many different fields of literature assosiated in this research, in order to be easier to study, related literature can be classified into 4 groups: (1) Literature related with methodology of materials selection in engineering practice, (2) Literature related with the development of expert system for selections in engineering practice (3) Literature related with materials for injection mold making, (4) other related literature.

2.1 Literature related with methodology of selection in engineering practice

Literature related with methodology of selection in engineering practice provide the guidelines, concepts in selecting materials used in plastic mold manufacturing. In addition, methodology of selection is considered as a crucial portion of knowledge inference system, which is significantly affected final solution generated by means of knowledge-based system. The examples of literature involved in this research are illustrated as follows:

Mahmoud, M.F. (1997, [1]) illustrated how introducing a new engineering product or changing an existing model involves making designs, reaching economic decisions, selecting materials, and choosing manufacturing processes fit together and what sort of trade-offs can be made in order to arrive

optimum solution for given application. The subject matter in this book is grouped into three parts. Part 1 discusses the performance of materials in service, a review of different types of mechanical failures and environmental degradation, and the selection of materials to resist failure. Part 2 concerns with the effect of materials and manufacturing processes on design of components. Part 3 deals with the selection and substitution of materials in industry. In addition, the various issues involved in the selection and substitution of materials, uses of computers and expert system in selection, and several detail case studies from a variety of industries are presented after a brief review the economics of materials and manufacturing process.

Chang-Ho, L. (1992, [6]) developed a manufacturability evaluation model for process selection. The computerized design aid called PROcess SELection (PROSEL) is discussed. One of the goals of this design is to assist less experienced design engineers during early stage of design. The focus of this approach divided into 3 sections. The first area is to identify the key factors which influence manufacturability. The second area is to propose a conceptual framework for selecting technically good processes. The third area deals with suggestion of a multilevel cost model called specialist structure for estimating the manufacturing cost.

Beiter, K.A. (1996, [8]) developed system cost based material selection, a procedure for considering mechanical requirements, manufacturing costs, and material selection in design of injection molded engineering thermoplastic parts. The benefit of this approach is the simultaneous consideration of the implication of material selection and part geometry on estimated manufacturing cost during candidate design selection.

2.2 Literature related with the development of expert system for selections in engineering practice

Literature related with the development of expert system concerning with selection in engineering practice play important role in this research. The example of those can be summarized as follows:

Pigford, D.V.,and Greg,B. (1995, [2]) lunched their book to offer users a basic understanding of expert systems and how they are developed. The first section of this text presents theory and gives users a broad exposure to expert systems, a branch of applied artificial intelligence. The second part of the book features a practical approach to using an expert system tool, VP-Expert Version 3.1. The authors suggest that VP-Expert was chosen because of its power, ease of use, cost and interface with spreadsheets and databases.

Agrawal, S.K. (1992, [7]) studies the size and location of the gate, which connects the cavity (or molding) with the runner and is usually the thinnest point of the whole system are determined by considering various requirements. This thesis deals with the development of an expert system designed to help with the preliminary selection of geometry and location of gate for an injection mold. The expert system developed is a ruled-based system that required the user to answer a series of questions that help determine the properties required for a specific application such as materials and size.

Wongsri, M. (1997, [13]) developed a prototype expert system for plastics selection (PLASA I) by using Smart Element Version 2.0 on a PC computer. The selection process comprises two stages. The first stage is to identify which materials properties are of interest to the user. The second stage of the selection process involves ranking of the properties required by weighing the user's requirements by means of AIM method (Alternative Inference Mechanism).

2.3 Literature related with materials for injection mold making

There are many literature related with materials for plastics injection mold making. The knowledge of materials for injection mold manufacturing acts as the knowledge base of knowledge-based system developed in this research. Literature comprising rules and facts for particular domain in making plastics injection mold are presented as follows:

Menges, G., and, Mohren, P. (1993, [3]) propose the book, How to make Injection Molds. This book is presented to provide every persons engaged in the design or manufacturing of injection molds with a reference work which covers the field of making injection molds in a comprehensive manner. The objective of this book is to assist in the design and production of injection molds. Further, information available in this book are supplied by practicing engineers and expertise within The Society of Plastics Engineers (SPE). In addition , SPE is also pleased to sponsor the Society publishes periodicals - Plastics Engineering, Polymer Engineering and Science, Polymer Processing and Rheology- as well as conference proceeding and other selected publications.

Stoeckhert, K. (1983, [9]) contributed to edit mold-making handbook for moldmaking guidelines. This book is applied to compress molding, transfer molding, injection molding and blow molding. The situation is somewhat different in the case of extrusion, where the die determines only two of the three possible dimensions. Extruder dies are dealt with in this book.

Berins, M.L. (1991, [10]) endeavored to edit SPI Plastics Engineering Handbook since the last edition was published in 1976. In the facet of injection mold manufacturing, three chapters on injection molding and tooling have been placed in the sequence in the new edition. This handbook cover all aspects of

the technology: machinery and equipment, tooling, materials, process variables, and case study of troubleshooting techniques for various plastic processing.

Mold Making & Mold design division and Southern California Section of the Society of Plastic Engineers (1989, [11]) presents " Mold Making book : a vision toward the future ". in 1989 The primary focus of Books is academic and professional resource materials originally published by publication of the Society of Plastic Engineers. This book provides SPE conference papers involving mold making. Selected conference papers and discussions will benefit readers the further understand of mold making. In addition, some papers provides the other book and resources to enhance reader's experience.

2.4 Other Related Lilterature

In this section, literature concerning this research in other aspects, rather than the 3 main topics mentioned above are presented. These literature enable clearer understanding of those topics and some other necessary topics such as specification of injecton mold machines. Other related literature can be summarized as shown below.

The Japan Steel Works, Ltd. (1990, [12]), intends to introduce a textbook for those handling JSW injection molding machines. JWS's textbook cover from the general information about plastics to the practical injection molding techniques. This textbook is suitable for inexpert as well because emphasis is placed on the underlying operation and precautions which should be understood in the molding practice.

Pacayamai, W. (1987. [5]) created a classification and coding (C&C) to assist the design and manufacture of injection mold components. In addition, this research proposed to develop software packages on a microcomputer and database which facilitates design and manufacture of injection mold design. A classification and coding (C&C) consists of nine schemes :1) Part Family

Scheme, 2) Material Scheme, 3) Fabrication Process Scheme, 4) Fabrication Tool Scheme, 5) Equipment Scheme, 6) Supplier Scheme, 7) Injection Mold Assembly Scheme, 8) Plastic Raw material Scheme, 9) Injection mold Product Family Scheme. A creation of C&C system, a software package written in C language, and a sample database benefit and cover the injection molds component manufacture.

Mo Zhen, M. (1996, [4]) conducted to develop a computer-aided design methodology that engineers could use to design injection molds for small and medium mold shops. In order to optimal product and mold design, existing and new methods are developed for mold flow analysis. In addition, in this thesis, there are cooling time calculation, flow front design, temperature calculation on each flow front and cooling channel design for achieving optimal mold design. These methods can serve as bench mark to test existing injection mold design and to optimal mold design.