

CHAPTER 1

INTRODUCTION



1.1 Scientific Rationale

The electrophotographic process, either in the form of printer and copier, is widely used for both medium- and high quality, and high speed short-run printing in the private and the business sectors. The high quality printout technology is desired for the development of computer, which can deal high definition color image and color documents. The electrophotographic process is gradually becoming a successor of the conventional printings, as shown in Figure 1-1.¹ The advantages of this printing process in terms of machine size, cleanliness, economy, speed, ease of operation, and strict environmental concern enforce the printing industry to use the solvent-less printing processes. They try to improve the printing qualities, higher solid density, higher resolution, and better tone reproduction, to achieve the qualities of offset lithographic printing. Reducing the toner size is popularly done to enhance the image quality, and the carrier property have to be investigated for a small toner size. Influential factors of the electrophotographic processes, development, transfer and fixing involves the developer properties which relate to the chemical and physical structures of the materials. The two-component developer efficiency and the print quality are affected by the toner tribo-charges, which depends on toner size, carrier size, carrier coating, toner concentration, and shaking time. Dependence of the toner charge on the above-mentioned parameters is investigated in order to achieve the optimum charge level for the good print quality. Fixing process governed by the thermal property of the toner is also determined.

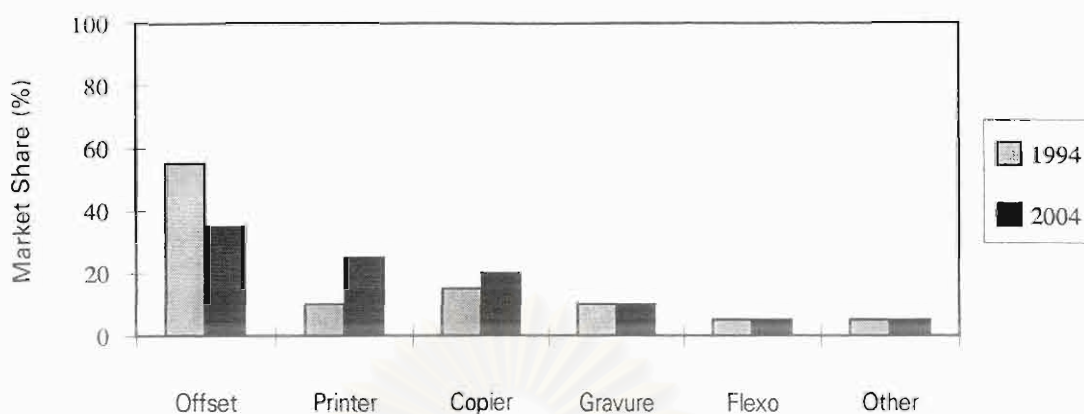


Figure 1-1 Trend of printing processes in the year 2004

1.2 Objectives

1.2.1 To determine parameters affecting characteristic of the two-component developer expressed as q/m values.

1.2.2 To analyze qualities of copy prints of the above-mentioned developer.

1.3 Scope of the Research

This research involved measurements and characterization of the dry toners mixed with the ferrite carriers. The carrier particle sizes and specialty carrier coated materials were varied while the type of toner was fixed. The important parameters for toner properties were the particle size and shape, and the particle size distribution that were studied by the Scanning Electron Microscopy and E-SPART analyzer. The charge-to-mass ratio was measured by a blow-off measurement with various toner concentrations and shaking times. The dependence of toner charge on the toner concentrations and the shaking times were determined, and the effective parameters of the carrier sizes, the carrier coatings and the carrier core particles, were analyzed from the q/m data. The single color copy prints, which were produced from a test form on the uncoated papers by a commercial copier calibrated by a

standard tester to elucidate the toner parameters governed print quality by the various toner concentrations and carrier types of the two-component developers. Qualities of copy prints were measured for density of the solid area, the background and the print tone reproduction with a densitometer, and the resolution with an image analyzer. In addition, determination of the correlated parameters of toner that affected print quality by a set of test condition was carried out. The thermal behavior of the developers was analyzed by a differential scanning calorimetry, and then the glass transition temperature and melting temperature were possibly obtained. The attainable results can lead to improvements of toner manufacturing for electrophotographic printing. The relation of the measured properties on the image properties can then be made.

1.4 Content of the Thesis

This thesis consists of 5 Chapters, introduction, theory and literature review, experimental, results and discussion, and conclusion. The theory in Chapter 2 gave a brief history of electrophotography, the basic processes, the types of development, the toner components, the characterization of toners, the toner fabrication, and the carrier materials, including short literature reviews of some previous work of toner particle sizes, charge properties of toner, rheology and fixing properties of toner, and new inventions of toners. The experimental in chapter 3 described the materials, the apparatus and four parts of the procedure, which examined toner and carrier particle morphology, determination of developer charge properties and the effective parameters, analyses of print quality, and toner rheology. The results of q/m measurement at the various T/Cs and carriers, the reproduction density and resolution, and the toner rheology were described in detail. Finally, the conclusion of the relation between the toner characteristics, and the print qualities was explained, and the T/C latitude corresponding to the q/m latitude was obtained.