CHAPTER 1

INTRODUCTION

1.1 Scientific Rationale

Electrophotography is a type of printing technology used widely in all copiers today because of its speed and quality. One of the critical steps in the electrophotographic process is the development step, which makes use of either a single-component developer or a two-component developer. These developers are different in their components and charging. An electrode is used for the single-component developer while a cascade development and magnetic brush development are used for the two-component developer.

The important parameters in the electrophotographic process are (1) electric charge and adhesion force of the toner particle, (2) charge distribution on the toner, and (3) charging mechanism that relate to both the image density and the print quality. Measuring the three parameters will result in the triboelectricity (q/m) unit, which also depends on various factors such as the mixing force, the toner concentration, the shape of toner, and the type of developer. The factors mentioned above control the charging mechanism and affect charging mechanism behavior of the toner.

This research investigates the effects of the mixing force, the toner concentration (wt%), the shape of toner, and the carrier types on the printing quality in terms of the solid density, densities at 60 and 40% halftones, background density, and edge sharpness of the electrophotographic prints. This research also tries to determine a new developing mechanism.

1.2 Objectives

The objectives of this research are as follows:

1.2.1 To elucidate the factors of the toner charging,

1.2.2 To elucidate the effects of the charging characteristics on the print quality.

1.3 Scope of the Research

This research involves measuring and characterizing the toners, which includes the irregular toner (KT-16a) and spherical toner (N-O9S), along with the carriers, consisting of the ferrite carrier (F-200) and steel carrier (TSV-200). The important parameters for the toner charge-to-mass ratio (q/m) were the shape of toner, the mixing intensity, and the mixing ratio between the toner and the carrier. The particle size and size distribution were studied using the scanning electron microscopy (SEM) and electrical single particle aerodynamic relaxation time (E-SPART) analyzer. The toner q/m values were measured by a blow off measurement unit with various rotating times.

The relationship between the toner charge and the mixing force, which is related to the rotating speeds and toner concentrations on different rotating times, were determined. The effective parameters of the shape of toner, the carrier types, and the current of carrier were analyzed from the q/m data. The print-outs, which were produced from a test form on the paper, were printed by OKI 400 micro line CL printer in order to elucidate the print quality with the various toners, KT-16a and N-O9S, on each paper. The quality of the print-out papers was measured for solid density at a solid area, densities at 60 and 40% halftones, and background density at a non-image area with a densitometer. The sharpness and smoothness of the lines and the characters were measured by an image analyzer. The results of this research will lead to an improvement of a developing mechanism for electrophotographic printing.

1.4 Content of the Thesis

This thesis consists of 5 chapters including (1) introduction, (2) theory and literature review, (3) experimental, (4) results and discussion, and (5) conclusion and suggestions. Chapter 2 presents a brief history of electrophotography, the electrophotographic process, toner components, two-component development, toner charging for two-component development systems and an overview of related studies. Chapter 3 discusses the details about the materials, apparatus, and the procedure of this research. Chapter 4 explains the details of the effect of the charge-to-mass ratios (q/m) on toner

concentration, the mixing force, the shape of toner, and the carrier types. The last chapter discusses the relationship between the toner characteristics and the print qualities.