CHAPTER 1

INTRODUCTION

1.1 Scientific Rationale

Electrophotography is a printing process, which was invented by Chester F. Carlson in 1938. Electrophotographic technology is applied for printers and copiers, which are widely used for both high and medium quality printers. The evolution of machines and materials for this system has been continually developed. In principles, electric field detachment occurs when the applied electrostatic force overcomes the toner adhesion force. So, the control of toner material is an important point. Main evaluation items of the printing process are print quality, printing speed and simplicity of a printing mechanism. Toner jet is a direct printing process where the image is formed directly onto the print media, for example, paper or belt. Although electrophotography has advantages of achieving high speed and good qualities, it suffers from disadvantages of high cost and complicated mechanism at the same time. Toner cloud beam (TCB) printing is one of the printing methods that is expected as being usable as a substitute for electrophotography. In this TCB printing method, which is a direct toner recording method involving a toner jet system, a toner can be controlled by a simple mechanism. Therefore, in order to develop the printing speed and simplicity of the printing mechanism simultaneously, which has been purposed to be faster than ink jet and lower in manufacturing cost than electrophotography, toner jet can be simplified using this TCB method.

1.2 Objectives

The objectives of this research are as follows:

1.2.1 To study the effect of the cone shape of a dented electrode, which is an effective confinement of the conductive toner cloud.

1.2.2 To study the toner characteristics resistivity, which is effective in confinement of the conductive toner cloud.

1.2.3 To study the possibility of toner transport by applying toner jumping phenomena.

1.3 Scope of the research work

This research involves the conductive toner cloud confinement using a cone shape hollow electrode for the measurement of the extent of conductive toner cloud and the toner jumping current. The extent of conductive toner cloud was calculated by Image-Proplus software and the toner jumping current was detected by the electrometer. Dependency of the extent of toner cloud and the toner jumping current on the cone shape of dented electrode, the toner resistivity, applied voltage, and the toner amount were determined for the conductive toner cloud confinement. Moreover, this thesis also investigated the toner jumping trajectory, which was calculated by ELFIN software.

The attainable results can lead to improvements of a dot formation mechanism for the Toner Cloud Beam method.

1.4 Content of the research work

This thesis investigated the conditions for the conductive toner cloud confinement. The thesis consists of 5 chapters including introduction, theoretical background and literature review, experimental, results and discussion, and conclusion and suggestions. Chapter 1 is an introduction of this thesis. Chapter 2 displays a brief description of nonimpact printing process, toner-based printing systems, the electrophotographic process, toner jet process, the toner component and characterization, the toner cloud generation, the toner cloud confinement condition, the toner cloud beam, and the short literature review of some previous reports. Chapter 3 describes the experimental materials, the experimental apparatus, and procedures of the experiment. Chapter 4 presents the results and discussion of the dependency of the toner jumping current on the applied voltage, diameters of the cone-shaped, dented electrode and the toner amount. In addition, the results of the dependency of the toner cloud extent on the toner amount and the applied voltage. Moreover, the jumping toner trajectory is calculated by ELFIN software. Finally, the results are concluded in Chapter 5 along with some suggestions. Many appendixes are presented for detailed information involving the experimental work and results. Appendix A gives the features of ELFIN program in which information leading to the calculation and simulation of toner jumping trajectory is given. Appendix B features the source code of the program from which etest.mai and etest.mei are given. Appendix C demonstrates the positions X, Y, Z from the output data (.mao). The output data from ELF/Bench for toner trajectory calculated by the btest.mao is presented in this Appendix.