CHAPTER 1

INTRODUCTION

1.1 Scientific Rationale

There are two basic technologies in digital printing for short run printing, one using toner-based solutions and another using ink-based solutions. According to ink-based solutions, inkjet is a direct-to-paper technology with no intermediate image carrier and is thus a direct printing. In the other hand, a laser printer, based on electrophotographic technology that is the most important and widely used in toner printing systems, requires a drum or image carrier to create the toner image and then transfer it to paper. This means that the cost per page of toner-based systems is rather high than of ink-based system. From this disadvantage, the trend of the new toner-based printing technology has been focused on a simple printing mechanism. One attempt is Toner jet, which is expressed to be faster than inkjet and lower in manufacturing cost than electrophotography.[1] Toner jet is similar to inkjet technology but different from electrophotographic technology in that it is a direct printing. In addition, toner jet processes the advantage in direct printing that easily achieves extremely a good and stable color registration at low manufacturing cost.[1] In 1999, A new dot formation method called "Toner Cloud Beam (TCB)" was proposed. Although TCB technology is also a direct printing technology but different from Toner jet in that it relies on the conducting toner while toner jet relies on the insulating toner. In TCB dot reproduction, toner beam is extracted from toner cloud generation by electric field applied between the electrodes and then the toner beam is projected to paper. To make this technology more understanding for the improvements in the future, this research work investigated the effect of applied voltage and aperture size of the control electrodes on toner dot size in TCB printing.

1.2 Objectives of Research Work

The objectives of this research are as follows:

1.2.1 To elucidate the effect of applied voltage on toner dot size.

1.2.2 To elucidate the effect of aperture diameter of the control electrodes on toner dot size.

1.2.3 To analyze the electric field of the dented electrode and control electrodes.

1.2.4 To simulate the particle trajectory.

1.3 Scope of the Research Work

For the reason of much clearer understanding the factors affect toner dot size in TCB printing mechanism, this research involved both experiment and simulation of conductive toner behavior in electric field. In part of the experiment, the TCB unit is set up and toner dots are created under the same condition except that only the toner jumping parameters interested are adjusted. For this case, the parameters include applied voltage and aperture diameter of control electrode. Then the toner dot size is measured and analyzed by mathematics. According to part of the simulation, we investigated the electric field between the electrodes generated by the applied voltage. The ELFIN software is used to calculate the electric field. This enabled us to explain results from the experiment. Moreover, the toner particle movements are also simulated by the ELFIN software.

The outcome of this research shall give some information for improvements of the new printing technology, TCB, which processes a simple mechanism for imaging.

1.4 Content of the Research Work

This thesis contains 5 chapters of introduction, theoretical background and literature reviews, experimental, results and discussion, and conclusions and suggestion. Chapter 2 concerns a brief of description of the toner-base digital printing system, toner types and literature review of TCB printing system. In Chapter 3, the details about the material, apparatus and procedure of this research are explained. Chapter 4 informs the results and discussion of the dependency of applied voltage and aperture diameter of control electrodes on toner dot size. Moreover, the electric fields and particle movements are simulated by ELFIN software. The final chapter presents the conclusions of the relationship between toner jumping parameters and toner dot size.