

CHAPTER 1

INTRODUCTION

1.0 Report Outline

This thesis is organized into seven chapters. Each chapter is systemically organized to contain the many spectrums involved in this project. This chapter, Introduction, will briefly put forward the objective, scope of study and background of this project. Chapter 2, Literature Review would talk about the history of microfluidics, scaling effects on microfluidics, Reynold's number, materials used, advantages and disadvantages of microfluidic devices, the application, and a brief discussion on capacitors. Chapter 3 covers the methodology involved in designing and fabricating the microfluidic capacitor in details. It also talks about why a specific method is chosen in this project and its adverse effects. Chapter 4 would discuss the observations and results obtained at each level of this project; design, fabrication and characterization. Chapter 5 is a proposal on how the device will be marketable as in its prospects and also on the marketing strategy employed to market the microfluidic capacitor. Conclusions and summary is put forth in Chapter 6. Further recommendations on how to further enhance the process and device is meticulously sorted in Chapter 7. Limitations and other crisis encountered throughout the project is also discussed here.

1.1 Objectives

The objectives of this project are to design a microfluidic capacitor, the processes involved, prepare the masks for fabrication, and fabricate the device and to characterize the electrical properties of the capacitor as a whole. This would be hands on experience of designing a process flow using the knowledge acquired in this engineering program.

1.2 Scope of Study

There are three main goals in this project. Firstly, an economic and comprehensive design on the fabrication process of a microfluidic capacitor is decided. Lots of research has to be carried out to study in the characteristics of a capacitor and fluid dynamics in micro scale. The second step is to actually fabricate the device in UniMAP's state of the art cleanroom. All the processes have to be refined and the parameters are set to optimize the yield. The recipe will be the essence of manufacturing the product. Finally, the device is characterized to verify its characteristics and capacitance.

1.3 Project Background

In this project, it is proposed to design, fabricate and characterize a Microfluidic capacitor. The main insulator channel is replaced with instead of the usual solid state material. The conductive material will be interdigitated electrodes of aluminum origin. The device will be fabricated using standard semiconductor processing technique. Since the insulator is substituted with fluid, thus the name Microfluidic capacitor.

Two techniques will be employed to check on the suitability of the steps to etch trenches where the aluminium interdigitated electrodes and fluid channels reside. RIE (Reactive ion Etch) a form of dry etch and KOH (Potassium hydroxide) a form of wet etch will be done to check on their etched profiles. All the other steps a run on a dummy wafer to verify the parameters before carrying out the actual fabrication.

The dimensions of this device are critically small for fabrication in UniMAP's cleanroom. A lot of challenges and mysteries lay ahead. The limitations will influence the device's functionality and performance.