

CHAPTER 5

CONCLUSION

5.1 Summary

From the observation to analysis, to sum it all, the BTST thin film sensor can be useful in various industries from heavy industries to consumer products. Owing to their features which are multi modes, they can be a heat sensor, temperature sensor, light (optical) sensor, gas sensor or as an ultra sonic sensor. Therefore, for this project, BTST thin film sensor was used as a “heat sensor” for room heat indicator. To sum it all from this project, BTST thin film has the feature as a sensor and it also sensitive to all modes that are being chosen for relevant application. The application was designed with combination of the hardware part with software part which includes the microcontroller.

Results from this project, shown almost all the objectives have been achieved. In addition, lots of learning process and knowledge has been obtained from designing stage of the application to development of the product. This project given true experiences in hands-on learning, the system level prototyping and testing that will be useful for future employment. BTST thin film is a good material to be researched in details because one day, this thin film technology will be in demand.

There are many limitations and problems that have been found. First, it started with the unstable or unreadable data that was from the sensor during packaging. Therefore, to overcome this problem by using sensor that has bigger metal contact to connect the wire to

connector by using silver conductive paint. Before starting any experiment or test, the sensor need to e heated first to release organic matters such as oxide that have deposited on the sensor surface.

5.2 Recommendation for future project

The following are the recommendations and suggestion for the future project:

- 5.2.1 In order to get good result for sensor characteristic, all the design and fabrication process needed for sensor, need to be done with more precaution.
- 5.2.2 Provide good equipment and components for the testing such as the built in chamber with temperature control, dummy sensor and many more.
- 5.2.3 Programming the PIC microcontroller for user interface that is more interactive including LCD display, 7-segment display and keyboard.
- 5.2.4 Do research about the BTST thin film sensor characteristic and the performance.

5.3 Commercialization Potential

Today's electronic applications are shrinking in size at a rate similar to the growing complexity of the devices inside. With more complex designs residing on smaller boards, temperature and heat management becomes a real issue. The importance of thermal management is gaining momentum, providing a strong market potential for devices servicing this function. Heat sensors have been used in many embedded applications, and of course more common in computer processor thermal management function. Obvious applications include power supplies, computers, peripherals, automotive, and industrial equipment. With low power products on the market, new applications are being uncovered, such as battery powered GPS instruments, and even high volume wireless handsets.

Therefore, the BTST thin film has potential to go further in the future and due to the new technology evolving, if this BTST thin film can prevail over their problems which are the sensitivity of a sensor to one application or as a multi mode sensor with certain sensor parameters to look out.

Based on a newly released world report, "SENSOR MARKETS 2008" by the Swiss company, INTECHNO CONSULTING, Western Europe is the leading consumer in 1998 with 31.7% of the world market, followed by the USA with 31.0% and Japan with 19.4%. The other countries account for approximately 17.9% of the world market. Sensor types with the highest demand volumes worldwide are heat sensors, temperature sensors, pressure sensors, flow sensors, binary position sensors (proximity switches, light barriers, reflector type photo sensors), position sensors, chemical sensors for measurement in liquids and gases, filling sensors, speed and rpm-sensors, flue gas sensors and fire detectors. The fastest growing types of sensors include rain sensors, thickness sensors, sensors that measure the quality of liquids, navigation sensors, tilt sensors, photo detectors, glass breakage sensors, biosensors, magnetic field sensors, and motion detectors. The worldwide sensor demand of US \$ 32.5 billion in 1998 comprises around US \$ 29.3 billion for housed and ready-to-use sensors and US \$ 1.7 billion for sensor elements without housing, US \$ 0.6 billion for sensor modules, and US \$ 0.9 billion for complete sensor systems. [12]

The world market for sensors base on semiconductor basis with concern all types of sensors, it grows from US \$ 12.6 billion in 1998 to US \$ 21.8 billion in 2008. Meanwhile, for fiber optic sensors is closed to US \$ 175 million at present, and will reach approximately US \$ 350 million by 2008. [12] In other hand, it comprises almost all types of sensors. From Figure 5.1, it shows an overview of the sensor market development for the major application sectors.

Therefore, referring to this report [12], BTST thin film can be a very useful sensor technology because of it's a multi mode feature which are can sense heat, optical, ultra sonic and also temperature. In the real world, the real benchmark for innovation success in new sensor products or sensor concepts is not the technological solution of a development

problem, but market acceptance. The goal of innovation marketing is not to push feasible technological concepts on the market, but to get marketable products by making market requirements the key factor in all development efforts on from the start. Chances in this field are resulting from the ever-changing customer requirements, which become more differentiated and more complex all time. [13]

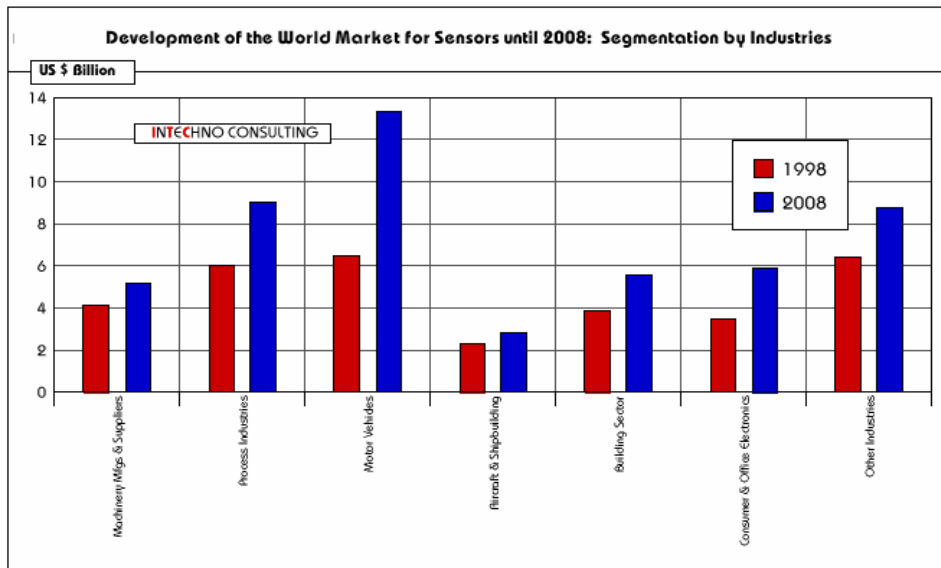


Figure 5.1: The sensor market development for the major application sectors [12]

Since not all expectations can be fulfilled, those customers who are most promising with respect to corporate philosophy have to be selected in order to form appropriate development partnerships for technology and service innovation. The customer's efforts to reduce production depth and to focus on core competencies offer a broad variety of opportunities for innovative service concepts, including sensor-based solutions with high value creation.