

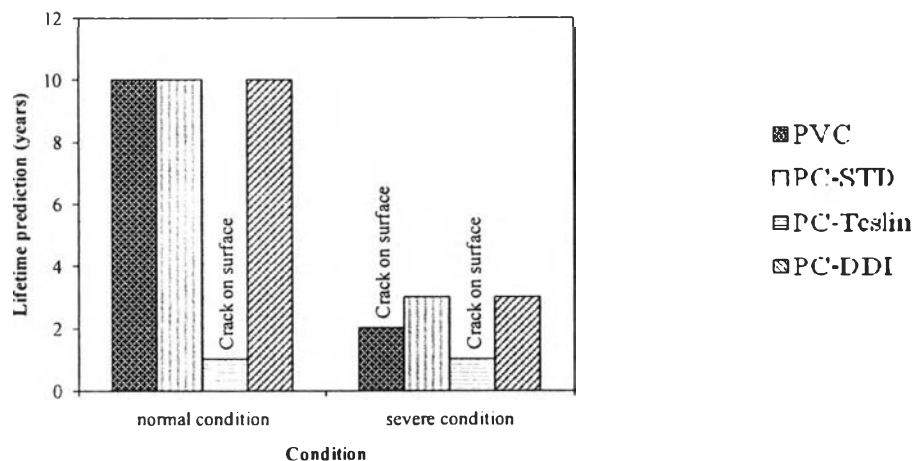
## CHAPTER VII

### CONCLUSIONS AND RECOMMENDATIONS

#### 7.1 Conclusions

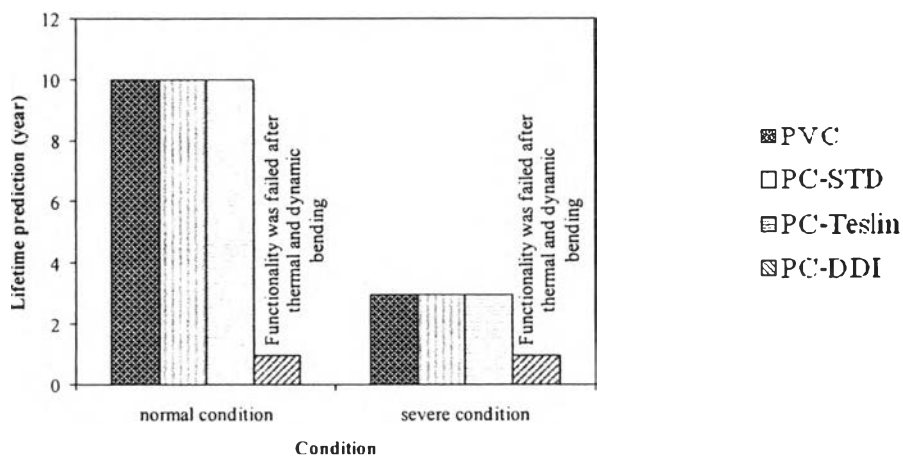
The plastic card containing a chip is called smart card which enhanced security in various applications. In this work, there were 5 type of plastic card, composed of 3 commercial plastic cards (PC-STD, PVC, and PETG) and 2 types of noble multilayer plastic cards (PC-Teslin and PC-DDI) obtained from Smartc technology company, Thailand. The finished card samples were then undergone several standard testing and qualitative checking to confirm their actual service lifetime and durability. The main problems of the commodity and engineering plastic are the photodegradation, thermal degradation or chemical degradation which involve the duration or service lifetime of plastic card. The conditions and accelerated aging were applied to test the plastic cards followed ISO/IEC 24789-1 and 10373-1 standard.

The results showed that the lifetime prediction was divided in 2 types. First, the plastic card was guaranteed by visual inspections which shown in Figure 7.1 (crack and fracture). In term of commercial plastic cards, The PETG surface generated the voids and cracking on the card surface after pass the first cycle testing, however, their surface failure was worst with increasing the cycle testing. The cracking and small white spots of PVC were presented after pass the second cycle testing in the severe condition. The last one of commercial plastic is PC-STD which only showed some scratch on surface due to the PC is higher stability at the same operating temperature. Thus, PC-STD is suitable for smart card than other types of plastic cards after characterize by appearance. In term of new multilayer plastic material, PC-Teslin micrographs showed the cracking on the surface while PC-DDI showed the same topology as PC-STD.



**Figure 7.1** The lifetime prediction of each plastic card after guarantee by visual inspections.

Second, the service lifetime prediction is based on functionality (data storage was measured by RFID). The results showed that the observation of functionality checking of their plastic cards show insignificant changing in functionality checking (max. distance). The maximum distance can be read even the crack were presented unless the plastic card was completely broken.



**Figure 7.2** The lifetime prediction of each plastic card after guarantee by functionality.

As a result, the durability and/or service life-time of plastic cards can be affected by many different environmental factors, for example, ultraviolet rays, humidity, ozone, heat, and pollution. The commonly found degradation effects are the changing of color, loss of gloss retention, reduction of mechanical properties, the slight crazing, the cracking and finally the completely breakdown of the polymer cards. Therefore, engineering plastic shows greater expectation of service lifetime. However, new fabricated materials such as PC-DDI lifetimes were generated from poor process building (TC bond poor). While PC-Teslin, the shorter lifetime was caused from the cracking on surface.

## **7.2 Recommendations**

For the future work, the other method such as weight and thickness of plastic card should be further investigated. In addition, the characterize of plastic card should be determined by using other techniques such as AFM in order to observe the morphology on plastic card. Moreover, the different type of plastic card should be determined in the future work.