ENGINEERING PLASTICS FOR ACTIVE CARD AND THE STUDY OF SERVICE LIFETIME

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ABSTRACT

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Smart cards are plastic cards containing a chip for identification. They provide enhanced security features in various applications. There are several types of commercial plastic used for smart card body such as PC-STD (polycarbonate), PVC (polyvinylchoride) and new multilayer materials such as PC-Teslin and PC-DDI. The drawback of these plastic is the degradation of their properties. The service lifetime of plastic relates to the mechanical properties, appearance of the surface and other properties. The commodity plastic card (PVC and PC) and new develop multilayer card material (PC-Teslin and PC-DDI) were tested to define the duration of the cards. Various conditions and accelerated aging were applied to the plastic cards according to ISO/IEC 24789-1 and 10373-1 standards. The changes in the properties of the plastic card have been analyzed by functionality (data storage devices must be checked after testing) tensile tests, scanning electron microscopy, gloss measurement, and colorimetric spectrophotometer. In term of visual inspection, each material had changing in ΔE (color difference) and a decrease in gloss retention. In term of mechanical properties, modulus of each material decreased. After two cycles, the lifetime of each plastic card was predicted. Both of PC-STD and PVC were found to have a lifetime 10 years in normal condition, however, PVC has more scratch than PC-STD. In term of severe condition, only PC-STD was found to have a lifetime for 3 years, while PC-DDI and PC-Teslin were passed the lifetime of 1 year

บทคัดย่อ

รัตนปทุม พิลาแดง : บัตรพลาสติกวิศวกรรมสำหรับแอคทีพการ์ด และการศึกษาอายุการใช้งาน (Engineering Plastics for Active Card and the Study of Service Lifetime) อ. ที่ปรึกษา : ผศ. ดร. หทัยกานต์ มนัสปิยะ 100 หน้า

บัตรสมาร์ทการ์ด คือ บัตรพลาสติกที่บรรจุแผงวงจรไว้ภายในตัวบัตร ซึ่งบัตรสมาร์ทการ์ดนั้นเป็นเทคโนโลยีใหม่ที่ใช้เพื่อเพิ่มความสามารถในการป้องกัน บัตรสมาร์ทการ์ดโดยทั่วไปมีหลายชนิด เช่น พีซี-เอสทีดี (พอลิคาร์โบเนต) พีวีซี (พอลิไวนิวคอไรด์) และ วัสดุหลายชั้นชนิดใหม่ เช่น พีซี-เทสลิน และ พีซี-ดีดีไอ ซึ่งผลเสียของพลาสติกเหล่านี้ คือ การเสื่อมสภาพของพลาสติก ซึ่งการเสื่อมสภาพของบัตรพลาสติกจะเกี่ยวข้องกับสมบัติเชิงกล ลักษณะของพื้นผิว และ สมบัติอื่นๆ ในการทดลองนี้ บัตรพลาสติกทั่วไป (พีวีซี และ พีซี-เอสทีดี) และวัสดุหลายชั้นตัวใหม่ (พีซี-เทสลิน และ พีซี-ดีดีไอ) ถูกนำไปทดลองเพื่อหาความทนทาน ที่สภาวะแวดล้อมต่างๆ และ และถูกเร่งอายุการใช้งาน ซึ่งอธิบายตามมาตรฐาน ไอเอสโอ/ไออีซี 24789-1 และ 10373-1 การเปลี่ยนแปลงของสมบัติต่างๆ จะถูกวิเคราะห์โดยฟังชั่น (ข้อมูลต่างๆ ที่เก็บไว้ภายในบัตร), ความสามารถในการต้านทานแรงดึง, การส่องด้วยกล้องจุลทรรศน์อิเล็กตรอนแบบสแกน, ความมันวาว และการเปลี่ยนแปลงของสี หลังจากการทดลองในส่วนของลักษณะภายนอกพบว่าพลาสติกแต่ละชนิดมีการเปลี่ยนแปลงของสีที่เพิ่มขึ้น และความมันวาวที่ลดลง และในส่วนของสมบัติเชิงกล ค่ามอลดูลัสของพลาสติกแต่ละตัวนั้นลดลง และพบว่าหลังการทดลองในรอบที่สองอายุการใช้งานของบัตรพลาสติกแต่ละตัวจะสามารถทำนายได้ว่า พีซี-เอสทีดี และ พีวีซี สามารถทำนายอายุการใช้งานได้ 10 ปี ในสภาวะปกติ แต่พีวีซี จะพบรอยขีดข่วนมากกว่า พีซี-เอสทีดี ในส่วนของสภาวะรุนแรงมีเพียง พีซี-เอสทีดี ที่พบว่ามีอายุการใช้งานถึง 3 ปี ส่วน พีซี-ดีดีไอ และ พีซี-เทสลิน พบว่ามีอายุการใช้งานเพียง 1 ปี

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