

Pattanachoke Kunapongkiti 2012: Nondestructive Mechanical Property Testing of Recycled ABS Plastic. Master of Engineering (Electrical Engineering), Major Field: Electrical Engineering, Department of Electrical Engineering.

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Adding recycled plastic into the overall composition is one of widely customary methods to reduce plastic waste. However, the mechanical properties of recycled plastic products are different from virgin plastic products. Therefore, quality control is required in manufacturing. Generally, universal mechanical testing is a destructive and time-consuming method. This thesis, therefore, presents an alternative, which is a nondestructive mechanical property testing of recycled ABS plastic. Furthermore, this technique aims for a cheaper and more convenient substitution. A spectroscopic method of measuring optical transmittance characteristics in near-infrared wavelengths is employed.

ABS plastic samples were prepared with various recycled compositions, thicknesses and colors. They were tested both near infrared optical characteristics and conventional mechanical properties, that are tensile and impact strengths. These properties vary with recycled compositions and thicknesses. The optical characteristics at wavelength of 1550 nm were utilized to distinguish the differences in recycle compositions. Since the percentage of optical transmittance is a function of recycle composition and, thus, tensile and impact strengths, the resulted mechanical properties can be calculated using equations derived from previously collected data and relationships. Linear relationships were employed with coefficient of determination ( $R^2$ ) over 0.8. A plastic sensor system was established. Laser diode sensor, thickness meter and color sensor were included, along with user-friendly commands and displays. Sensor measured data was collected. Finally, comparisons between results from conventional mechanical testing and calculated results were made. The comparison results showed that the normalized root mean square errors (NRMSE) are in an acceptable range.

In conclusions, the proposed recycled plastic sensor system was established and verified. The results indicate that the spectroscopic method of laser diode, integrated with colour and thickness measurement units can be employed in replacement of destructive mechanical testing. The sensor system exhibits accuracy and simplicity with conveniences and low cost maintenance. It is expected that the system can eventually help promote the addition of recycled plastics, so that the waste can be reduced.

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Thesis Advisor's signature

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