P2-8 **Optical System for Measuring a Rib Size of the Polyethylene Sheet**

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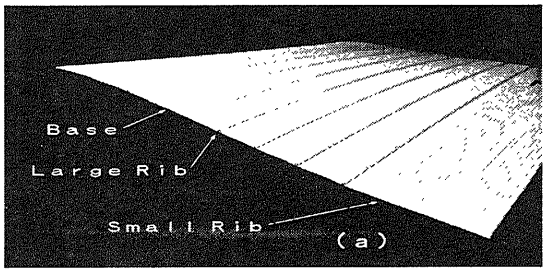
1. Introduction

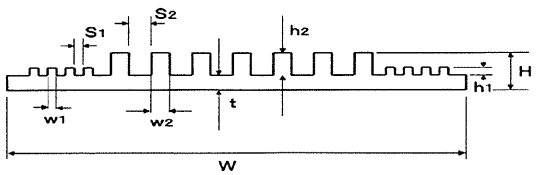
Polyethylene sheet has widely been used in industry. For an example, it has been used in a battery as an impregnation material of sulfuric acid. For such application, the ribs have, usually, been constructed on the sheet surface to control an amount of sulfuric acid: a performance of an electric power will be determined by the rib's size. The size, i.e., a width and a height, and the separation between ribs have, hitherto, been measured by microscopic observation by human eye. It is very laborious and time-consuming works.

In this paper, we have developed an optical system for a measurement of rib's size and a thickness of the sheet in real time.

2. Method and System

Figure 1 shows a photograph of the polyethylene sheet used in a battery (a), and a schema of it (b). The sheet has, usually about 10cm in width, about 20cm in length and a few tenth mm in thickness.





(b)

Figure 1 Photograph of the Polyethylene Sheet (a) and Schema of it (b)

Figure 2 shows the principle of the method. A laser sheet was used for the measurement. A transmitted light is linearly proportional to a gap between a shielding plate and a polyethylene sheet. A height, h, and a width of the rib, w, a separation between ribs, s, and a thickness of the polyethylene sheet, t, can then be measured by scanning a laser sheet as shown in this figure.

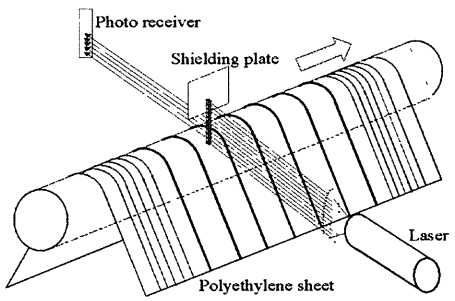


Figure 2 Sensor Head of the system

Figure 3 shows a block diagram of a whole system and figure 4 shows an photograph of the equipment. In practice, a laser and a silicon photodiode was fixed and the polyethylene sheet was moved by using a stepping motor with a 1/100mm precision. A control signal was synchronized with the received laser signal to measure widths of a rib and a polyethylene sheet, and a separation between ribs. A received light intensity was amplified and digitized by a 12-bit A/D converter.

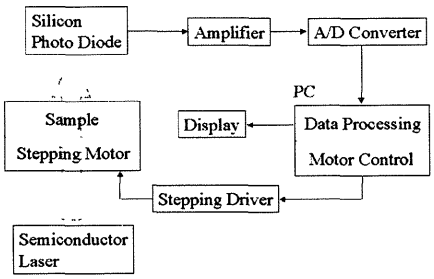


Figure 3 Block Diagram of the System

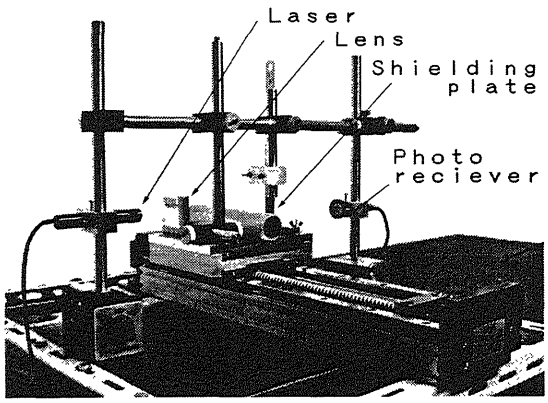


Figure 4 Equipment of the System

3. Experimental Result

Figure 5 shows a transmitted light intensity across the polyethylene sheet with ribs. From the figure, a thickness of the polyethylene sheet, t, and a height of the rib, h, can be obtained by an amount of a decrease in light intensity due to sheet and rib. A width of the polyethylene sheet, W, and a separation between ribs, s, can, also, be obtained by measuring a distance between each abrupt change of the light intensity. These values for each sample sheet were obtained within about 20s.

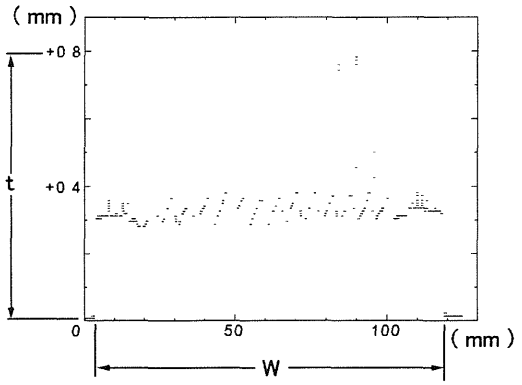


Fig. 5 Transmitted Light Intensity Across the Polyethylene Sheet

4. Conclusion

An optical system has been developed for measuring a thickness and a width of polyethylene sheet and a size of a rib on the surface, in real time. The system consisted of sensor head including laser and silicon photodiode, scanning system of the polyethylene sheet, and a data processing system. The precision of the measurement was about 1/100mm and a time required for the measurement was about 20s. The system has, now, been used in practical plant in the manufacturing factory.

Acknowledgement

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