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Quantitative Analysis for Polymer Degradation in the Extrusion Process

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Polymer degradation in the extrusion process decreases quality and productivity. For this reason, it is necessary to prevent polymer degradation. In the extrusion process, polymer degradation is caused by oxidation. It depends on the processing temperature and the amount of dissolved oxygen in the molten polymer. Therefore, it is required to establish the quantitative analysis of these factors.

Thus the purpose of present paper is to clarify the behavior of polymer degradation in the extrusion process focusing mainly on the quantitative analysis for dissolved gases in the extruded molten polymer.

An online measuring apparatus to analyze dissolved gas in the extruded molten polymer was developed. With this apparatus, the volume ratio of dissolved gases (nitrogen, oxygen etc.) to the extruded molten polymer could be quantitatively analyzed and the quality of the extruded molten polymer could be evaluated.

With this apparatus, dissolved nitrogen (index of entrained air) was analyzed with a full-flight screw and a barrier screw. Furthermore, observation of cross sectional views in the screw channel obtained from the cooling experiment under the operating conditions was carried out for the full-flight screw and the barrier one. With the full-flight screw, break up phenomenon (collapse of solid polymer) occurred in the screw channel and the amount of nitrogen increased. With the barrier screw, the amount of nitrogen relatively decreased because of prevention of the break up phenomenon in the screw channel.

Consequently, it is clarified that the use of the barrier screw is suitable for oxygen reduction in the molten polymer, which is a factor in causing polymer degradation.