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Characteristics of γ-Irradiated Heat Shrinkable High Density Polyethylene

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High density polyethylene(HDPE) is one of the most important thermoplastics. But its use is restricted in certain applications by its low melting point, solubility in hydrocarbons and a tendency to crack when stressed. One big disadvantage in the use of thermoplastics such as HDPE comes from its tendency to thermoplastic flow or deformation at elevated temperature. In heat shrinkable use, this can lead to excessive melting of HDPE during the manufacturing process of heat shrinkable tube and reduction in electrical and mechanical properties owing to degradation of HDPE molecules by heat. In order to solve the problems, the material properties of the present HDPE must be improved. The goal of many investigators has been to alter the properties of HDPE by changing the material's morphological characteristics. The investigation of the γ-irradiation effects on HDPE is important in order to improve its physical property. It is well known that γ-irradiation introduces free radicals into polyethylene. These free radicals can in turn lead to cross-linking of the polymer. In the present work, HDPE was mixed with cross-linking agents to obtain efficient cross-linking yield in spite of low dose rate for heat shrinkable tube. In this paper, attention was focused on the effects of the γ-irradiation on the changes of shrinkage and thermal mechanical properties of HDPE, irradiated at a dose of up to 100 KGy.

Mixing of the HDPE and the cross-linking agent was accomplished by using Brabender at 180℃. Prepared mixture samples were pressed into 0.2 mm sheet. Specimens were irradiated with γ-rays at room temperature in nitrogen atmosphere. Cobalt-60 was used as the source of γ-irradiation. Radiation doses were conducted at a doses at 40 kGy to 100 kGy.

The effects of gamma irradiation on cross-linking of high density polyethylene (HDPE) was investigated for the purpose of obtaining a suitable formulation for heat shrinkable tube. Heat shrinkable property and thermal mechanical property of HDPE have been investigated. It was found that percent cross-linking of the irradiated samples were increased with irradiation dose. Heat transformation and dimension change of HDPE were decreased with increasing radiation dose.