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Structure and Exothermic Behavior of Poly(butylene terephthalate) and Poly(ethylene terephthalate) Films

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Necking phenomenon and exothermic behavior were observed during tensile tests. Temperature rise due to tensile deformation of films occurred at both necking and neck propagation parts. Relationship between exothermic behaviors and structure has been investigated using PBT melt press films having various crystallinity by annealing. It was clarified that second yield point where necking occurred during tensile test shifted to higher strain region and temperature rise increased with increasing crystallinity. Existence of α and β crystal forms was determined by appearance of the specific peaks of α and β crystal forms using FT-IR (ATR). PBT melt press film had only a crystal forms. After tensile test, the necking part showed β crystal form. The transition of two crystal forms in PBT was confirmed at necking point. Uniaxially stretched PBT and PET films were prepared to compare the effect of orientation on exothermic behaviors during tensile tests. Moreover, in the case of PET, the transition of crystal forms could be ignored because PET has only one crystal form. Draw ratio of machine direction were varied from 1 to 5. Higher orientation appeared with increasing draw ratio of films. In the case of machine direction samples of the high orient films, the necking phenomenon did not occur and the exothermic temperature rise was observed all region of specimen just before the breaking point. On the other hand, the transverse direction samples showed necking phenomenon. It was found that the necking phenomenon did not occur during tensile test on the direction of molecular chain or c-axis of crystallite. It was considered that the double orientation occurred in high orientated films resulting from the (100) X-ray reflection decreased with increasing draw ratio in wide angle X-ray diffraction. The effect of orientation on exothermic and tensile behaviors was discussed.