平成 11 年度博士論文要旨

平成9年度入学　大学院博士後期課程　物質生産工学専攻（材料物理工学講座）

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論文題目：プラスチック複合系のタフネス改善に関する研究

英訳題目：A study on the Toughening Mechanism of Plastic Composites

- Abstract

Polyphenylene sulfide(PPS) is one of the the popular engineering plastics,and it exhibits excellent properties in thermal and chemical resistance.It is known that the toughness of PPS is improved greatly by blending theelastomer with the matrix. There were some papers on the toughening mechanismfor the polymer blends, but the explanation from the fractural mechanicswas not enough. On the other hand, it was pointed out that the brittlefracture of the polymer results from the failure of the fibrils in the crazewhich was formed by the concentrated stress at the tip of the notch. Then,two methods for toughening the polymer, ①increasing the strength of thecraze, ②relaxing the stress concentration caused by the constrained strain,were indicated.

In this study, basing on these theory, the toughening mechanism and thematerial design technique were investigated by the plastic analysis, mechanicaltests and morphological observations.

Then, it was proved as follows.

(1) It was analyzed that the stress concentration in the polymer blendswas relaxed by the release of constrained strain which was caused by thevoid formation in the elastomer having low tensile strength.

(2) The toughening mechanism for polymer blends could be explained theoreticallyby using slip line field theory.

(3) The results from the plastic analysis showed good agreement with experimentalresults in the case of uniform fine dispersion of elastomer.

(4) In the case of PPS/SEBS blends, it was confirmed experimentally thatthe decrease in the tensile strength of the elastomer, the increases inthe molecular weight of the matrix and the content of the elastomer weremuch effective on toughening of the blends.

Thus, the effective design technique for the polymer blends was proposedby the plastic analysis and experimental results, and it is expected thatthe technique could be applied generally to the polymer blends.