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Rubber as Additives To Lower Thermal Expansion Coefficient of Plastics: A New Technology

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One of major issues for polymers in engineering applications is to reduce the thermal expansion coefficient to achieve dimensional stability more comparable with metals. The traditional concept to lower the thermal expansion coefficient of polymers is adding inorganic filler with relatively low thermal expansion coefficient and suppressing the expansion by simple mechanical restraints. However, materials prepared from this approach often suffer from poor toughness, bad appearance and difficulty in processing. In this study, a substantial approach was proposed to lower the coefficient of linear thermal expansion (CLTE) of plastics without sacrificing their impact resistance. Rubber was used as an additive to tune the thermal expansion behavior of various plastics. Although the rubber has a high thermal expansion coefficient, it was confirmed that when the rubber domains are deformed into microlayers and co-continuous with the plastic matrix, the CLTE of the polymer alloy parallel to the microlayer directions could be reduced to a very low level. Various influencing factors including rubber concentration, viscosity ratio, interfacial adhesion as well as the domain size were investigated.