Abstract

The rheological and self-healing properties of Poly(vinyl butyral) (PVB) are studied. It is found from the viscoelastic measurements that the polymer has low level of entanglement molecular weight M_e and high rubbery plateau modulus G_N^0. Because of the relatively high value of G_N^0, it hardly shows shark-skin failure, i.e., the surface roughness on the extrudates at extrusion processing. Therefore, it can be processed at high out-put rate condition. Moreover, the low M_e is responsible for a rubbery region in the wide temperature range. Therefore, it barely shows macroscopic flow in the rubbery region. Furthermore, it is found that PVB shows self-healing behavior even below the glass transition temperature T_g. A large amount of water is found to be adsorbed on the surface of the film. This is attributed to the surface localization of hydroxyl and carbonyl group in PVB, which is confirmed by X-ray photoelectron spectroscopy. Since the surface is plasticized by the water, the scar applied by a razor blade is healed even in the glassy state of the bulk. Moreover, the healing efficiency is enhanced at high humidity condition, owing to the pronounced plasticizing effect by water. This can be noted that self-healing products of PVB are appropriate to be used for outdoor goods.

KEYWORDS: rheology; capillary extrusion; viscoelastic properties; self-healing property; thermoplastics