Property modification of PVC products

Since PVC has a high polarity and high compatibility with a variety of other high-performance plastics, it is possible to mix these easily to form polymer alloys. By polymer alloying techniques some of the shortcomings of rigid PVC products can be modified. Fig.1 shows the outline of property modification through polymer alloying.

In addition to the polymer alloying technique, modifications of heat resistance etc.

Impact resistance

Generally, in order to improve the impact resistance of PVC products, impact modifiers (toughening agents) which have rubber-like properties such as ABS, MBS, acrylic rubber, chlorinated polyethylene or EVA, are mixed with PVC. Sufficient impact resistance for practical use can be obtained by blending 5~20 weight parts of these impact modifiers to 100 weight parts of PVC. The impact modifier in the form of micro particles is dispersed within the molecular structure of PVC. When the PVC products receive an impact, these micro particles in the molecular structure absorb the impact energy and prevent damage to the PVC product. PVC whose impact resistance is modified is used in a wide range of applications including exterior construction materials (window frames, siding), industrial boards, impact resistant water pipes, rigid PVC packaging (blister packs, caps, casings), surface protecting films, or electrical parts (connectors).

Heat distortion temperature (softening temperature)

In order to enhance the heat resistance, heat distortion temperature or softening temperature of PVC products, heat resistant resins such as ABS resins, α -methylstyrene copolymers, or afterchlorinated PVC are usually blended in. Fig.3 and Fig.4 show the improvement of the softening temperature by blending ABS as an example, and the improvement of thermal deformation temperature by blending after chlorinated PVC, respectively.

PVC with enhanced heat resistance is used for heat resistant rigid PVC pipes, such as hot water supply pipes or electric cable protecting tubes, and instrument panels of vehicles. On the other hand, soft PVC products with modified heat resistance can be manufactured by blending with a
Prevention of plasticiser bleed and volatilisation

In order to prevent bleeding, volatilisation or migration of plasticisers to other materials from soft PVC products, plasticizers with high molecular weight or high compatibility with PVC are adopted. Fig. 5 shows an example where a polyester plasticiser with a molecular weight of 1,500 is used to replace DOP, which is a general-purpose plasticiser with a molecular weight of 390. Test pieces are placed in an oven of 160 °C and rates of weight loss are measured to represent volatilisation of plasticisers as time elapses.

On the other hand, plasticiser free flexible PVC products are manufactured as in the case of graft polymerised EVA (ethylene vinyl-acetate copolymer) and PVC, or a terpolymer composed of ethylene-vinyl acetate-carbon monoxide. PVC including plasticisers which do not migrate or bleed at high temperatures is used for electric/electronic parts and heat resistant cables. Some of the non-migrating type plasticizers are used for medical bags/tubes or industrial hoses.