Processing and assembly

The processing and use of adhesive tapes appear to be extremely simple; cut to size and apply. One should, however, ensure that the adherent surface is clean enough, that the application pressure is even and that the tape surface is not damaged during the application.Sometimes tapes shall be perforated all over their surfaces; this allows evacuation of trapped or generated gas bubbles under vacuum (particularly with metal-backed tapes). Perforated tapes should be used to enable the correct evacuation of trapped air bubbles underneath the adhesive tape. When perforated tapes are not used, the process of tape application and removal of bubbles shall be documented.

Precautions

Because of the complex and frequently unknown nature of their adhesives, use of tapes should be minimized and then only with great care in their choice and application. When an adhesive tape is applied temporarily, it generally contaminates the underlying surface which shall be carefully cleaned after tape removal.

When tape is applied permanently it can be displaced by creep and leaves a dirty spot. Cleaning solvents can accidentally damage the adhesive or the tape, or be absorbed into them and diffuse out when vacuum exposure takes place. The top face of some adhesive tapes is coatedwith a release agent that can discolour during subsequent vacuum or UV exposure - this should be removed.

Hazardous or precluded

Polyvinylchloride backing tapes which are frequently used for electrical insulation shall not be applied to space vehicles. Also cellulose (cellophane), cellulose acetate, paper and fabric should be avoided. Tape of unknown origin shall not be used.

Effects of space environment

Vacuum exposure can draw products out of the backing when it is a polymer and also out of the adhesive. When the tape is applied, outgassing takes place through the backing by diffusion when it is permeable and also through the bond line. Outgassing products and entrapped air can lift the tape or bubble it unless the tape is perforated. Adhesives mainly generate condensable products which are dangerous contaminants for optics and electronics. The release of such products, which are frequently plasticisers or tackifiers, can harden the adhesive layer and render it inoperative. Practically each new type of tape shall be tested for outgassing: present results do not allow a generalized statement to bemade regarding safe tapes for space application, but acrylic adhesives seem to be the better choice.

Radiation (UV and particle) shall be considered mainly when tapes are used for thermal-control purposes.Most polymer backings are sensitive and their solar absorptivity increases rapidly under irradiation. The best choice forUV resistance is polyimide or fluorinated resins.When the backing ismetallized on the side of the incident light, optical properties are quite stable. Metals are not affected, although discoloration can occur when they are coated with a protective varnish. Radiation has a tendency to harden polymers and render them brittle. Dimensional stability of polymer tapes is frequently poor under space conditions.

High temperatures up to 200 ºC can be sustained by polyimide, silicone and PTFE tapes with suitable adhesives (silicone). Metal and glass tapes are limited by the properties of the adhesive to similar temperatures.

Low temperatures stiffen the adhesive and backing. Polyimide and Teflonbased tapes can still be used as well as metal.

Thermal cycling is in general not a problem since the pressure-sensitive adhesives are quite flexible except at low temperatures.

Atomic oxygen in low orbit can attack polymer tapes. The exposure to the space environment shall not impair the function of the tape.