CHAPTER V

EXPERIMENT

5.1 RAW MATERIAL

5.1.1 ELVAX 260 as base polymer

HERCOTACK 1149 as wetting agent

SASOL wax as viscosity reducer

DBP as plasticizer

BHT as antioxidant

5.1.2 Adherend material

Card board paper of 0.6 mm that laminated with polypoprelene film is used as adherend. One side of paper is light grey colour, another one is white and film is applied on this side. Hotmelt adhesive will be coated on PP film.

5.2 LOW-HIGH CONSIDERATION

In this experiment ELVAX 260 is base polymer of hotmelt adhesive, so it is not specified as factor. The raw materials that chose as factor are as following

5.2.1 Hercotack 1149 had been pretest by adding between10 to 50 % in the formula. It has positive effects for adhesion but if add too much , this will make

the adhesive become harder , crack and poor adhesion. Then 12.5 is selected to be the lower side and 25 % is selected to be the higher side of levels of this factors.

5.2.2 Sasol wax is an importance viscosity reducer in hotmelt adhesive but from pretest it has negative effect for adhesion. Then a small amount of 1 % for the lower limit and 5 % for the upper limit wax are chosen.

5.2.3 DBP is plasticizer that expected to add for two reason. First it will soften the adhesive or the softer polymer always have better flexibility and tacky property. Second reason to add DBP is to reduce viscosity. But from pretest if large amount of DBP is used it will penetrate to the surface of the adhesive and reduce adhesion. Therefore a small amount of 1 % for the lower limit and 5 % for the higher limit are two levels for this factors.

5.2.4 Antioxidant BHT is not direct effect the adhesion , But high temperature processing may cause polymer oxidation and poor adhesion. So 0.5% for the lower limit and 2% for the upper limit 0f BHT is varied to find optimum quantity.

5.3 EQUIPMENT

There are several important equipments that used for adhesive preperation.

5.3.1 The first one is mixing machine type R 50D of CAT Geramany, (figure 5.1) variable speed from 0-1700 rpm, 120 W (see fig 5.1) that used to agitate adhesive compounds together. The machine must enough power to agitate

viscous melted adhesive slowly but speed cannot too slow because adhesive compound willdecompose at the surface contacted to heater.

5.3.2 Heater type M17 of CAT Geramany (figure 5.2), with heat control, 640 W. Heater surface temperature is set at 200 C to maintain the adhesive to melt at 150 C.

5.3.3 Vessel for compounding adhesive is stainless steel, 800 cc capacity (figure 5.2).

5.3.4 Coating machine (figure 5.3)is specially develope for this hotmelt experiment. There are two rollers with pressure adjustable screws at both ends for controlling the thickness of adhesive that will be coated on adherend. Speed of pressured roller must be very slowly to allow the adhesive to melt from adhesive gun.

5.3.5 Adhesive gun type GG-5 of GLUE GUN Taiwan (figure 5.4), 40 W. This gun is used to melt adhesive from solid to liquid form and coat it on the surface of adherends.

5.3.6 Mould is also specially made for the experiment. the melt compound adhesive will be formed as a rod stick of 10 mm diameter, 260 mm length in this mould before using with the gun.

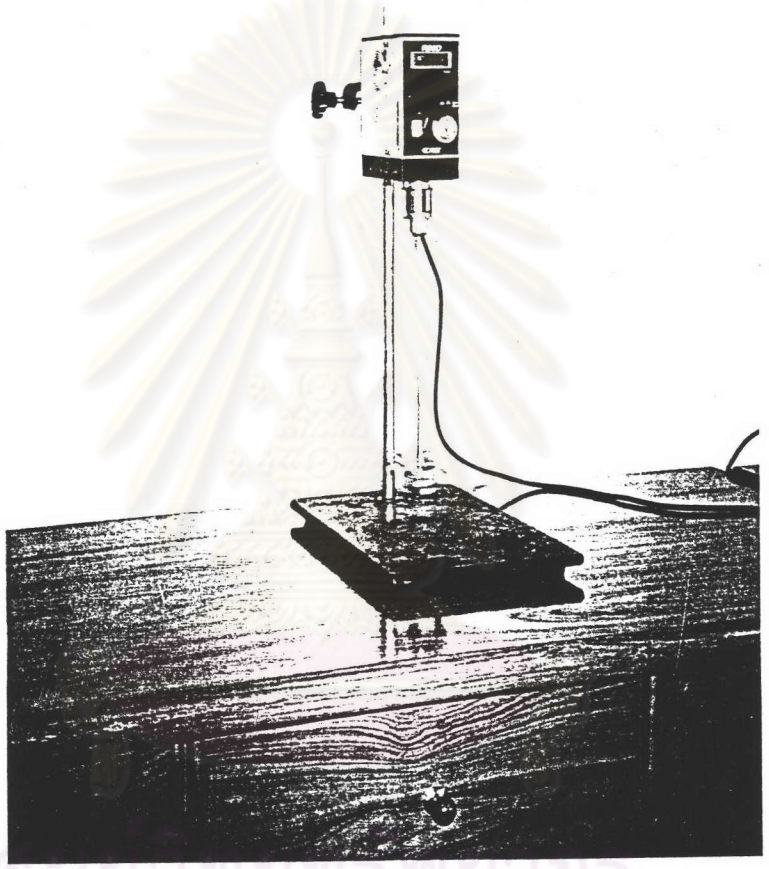

FIGURE 5.1 Mixing machine

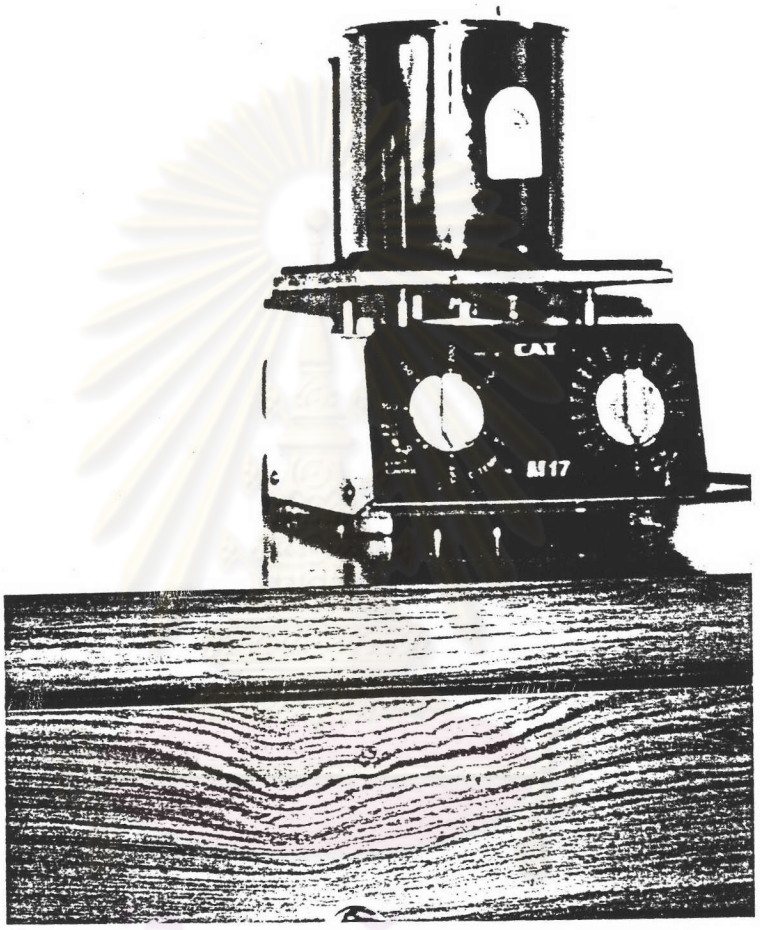

FIGURE 5.2 Heater

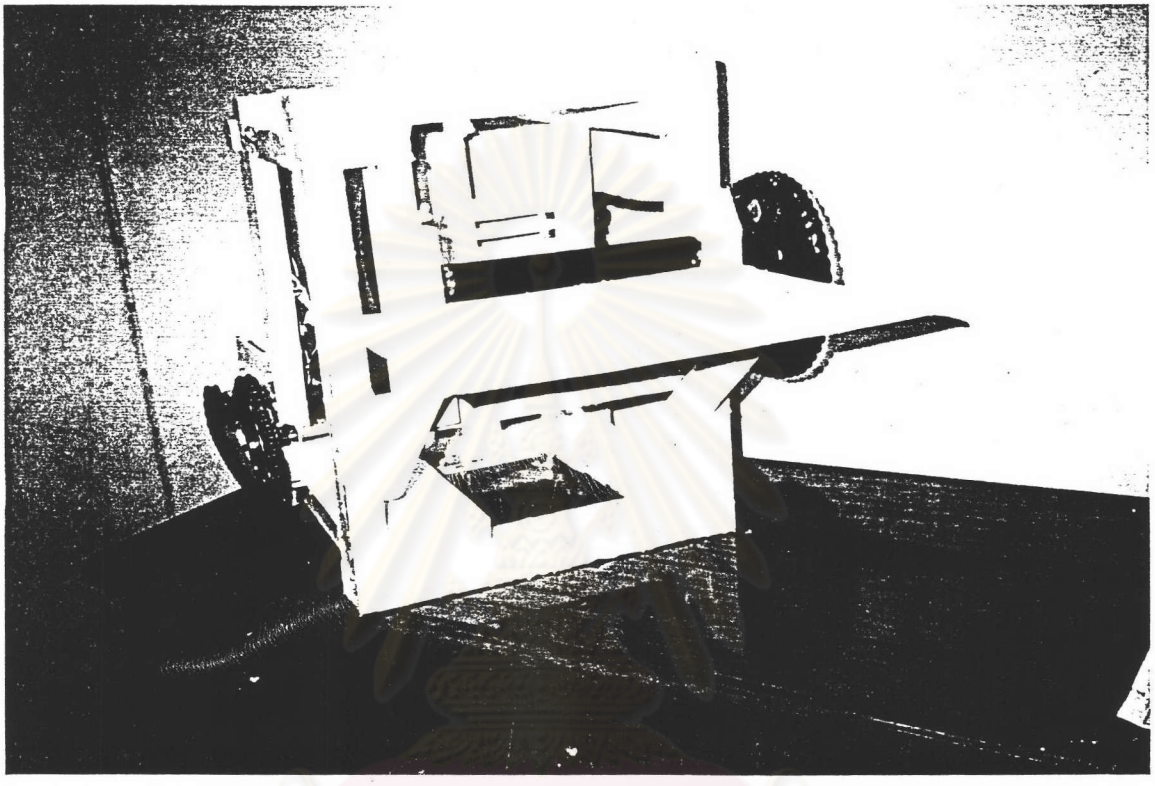

FIGURE 5.3 Coating machine

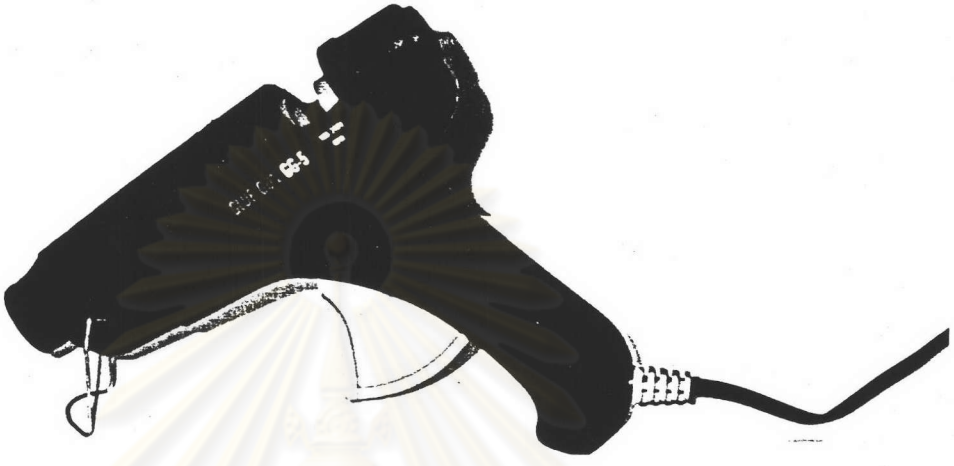

FIGURE 5.4 Adhesive gun

5.4 METHOD OF EXPERIMENT

5.4.1 Formulation Process

According to the first formula of hotmelt adhesive in the table 6.3. Heater is setting up at 130 C , speed of mixer is about 100 rpm. Fill 1 gm of DBP into the stainless vessel then 12.5 gm Hercotac 1149 and BHT are added . The mixture will melt together when temperature reach 100 C . Add 1 gm wax, it also melt readily into the mixture . In this step temperature of the mixture will stable at about 100-110 C and its appearance look like viscous liquid .

Raise heater temperature to 180 C , wait until mixture temperature to reach 150 C , slowly add EVA while stiring well (temperature of heater always higher than mixture 20-30 C). At this step viscosity of the solution will highly increase according to the amount of EVA, The mixing machine still have enough power to stir the mixture. As the mixture is well mixed , it appear like viscouse liquid that ready to perform as pellet , rod or any shape up to the end use.

In this experiment we have to prepare the hotmelt adhesive in the form of rod that look like cylindrical candle , by casting the melt adhesive mixture in the mould, let it cool to become solid form, then pull out. Shaping it to cylindrical for adhesive gun.

5.4.2 Bonding process

The bonding process cannot applied to the sample according to ASTM process because of hotmelt adhesive property that have a short seconds open time . This bonding process cannot apply adhesive on all adherend surface of 25.4x228.6 mm because it will become hard solid before bonding process is complete. So three point of process is applied to meet ASTM standard by first develope the gun to feed large amount of melted adhesive slowly onto the laminated paper, second develope the coating machine that have two rollers slowly squeeze the bonding papers to spread melted adhesive perfectly cover the adherend surfaces that needed, third laminated papers are cut to double wider from ASTM specification. Film laminated paper is cut to 50.8 mm width and 304.8 mm length. Adhesive rod is insert into the gun wait until temperature raise to about 150 C, then press the melt adhesive slowly onto the paper adherends (see fig) while feeding into the roller until 228.6 mm of paper is coated, and 76.2 mm which is the remainder of the paper will not be coated for tension clip holder. Cut the bonded paper from 50.8 mm wide to 25.4 mm by cut each side 12.7 mm. Then every bonded paper will have equal bonded surface area as needed.

5.5 TEST METHOD ASTM

Test method is the Standard Test Method for Peel Resistance of adhesive (T-Peel Test), ASTM D 1876-93

The accuracy of the results of strength tests of adhesive bonds will depend on the conditions under which the bonding process is carried out. Procedure for

preparation of the surface prior to application of the adhesive, the cleaning and drying of metal surfaces, and special surface treatments such as sanding, which are not specifically . Complete mixing directions for the adhesive. Conditions for application of the adhesive, including the rate of spread or thickness of film, number of coats to be applied, whether to be applied to one or both surfaces. Assembly conditions before application of pressure, including the room temperature, length of time.

Scope of this test method is primarily intended for determining the relative peel resistance of adhesive bonds between flexible adherends by means of a T-type specimen.

Tension Testing Machine (figure 5.5), capable of applying a tensile load having the following prescribed conditions. The machine and loading range shall be so selected that the maximum load on the specimen falls between 15 and 85 % of the upper limit of the loading range. The rate of movement between heads shall remain essentially constant under fluctuating loads. The machine shall be equipped with suitable grips capable of clamping the specimens firmly and without slippage throughout the tests. The machine shall be autographic, giving a chart. The applied tension as measured and recorded shall be accurate within $\pm 1\%$.

Test speciment shall consist of two flexible adherends properly prepared and bonded together in accordance with the recommendations. Specially prepared test panels shall be 152 mm (6 in.) wide by 305 mm (12 in.) long, but shall be bonded only over approximately 241 mm (9 in.) of their length. Test panels of

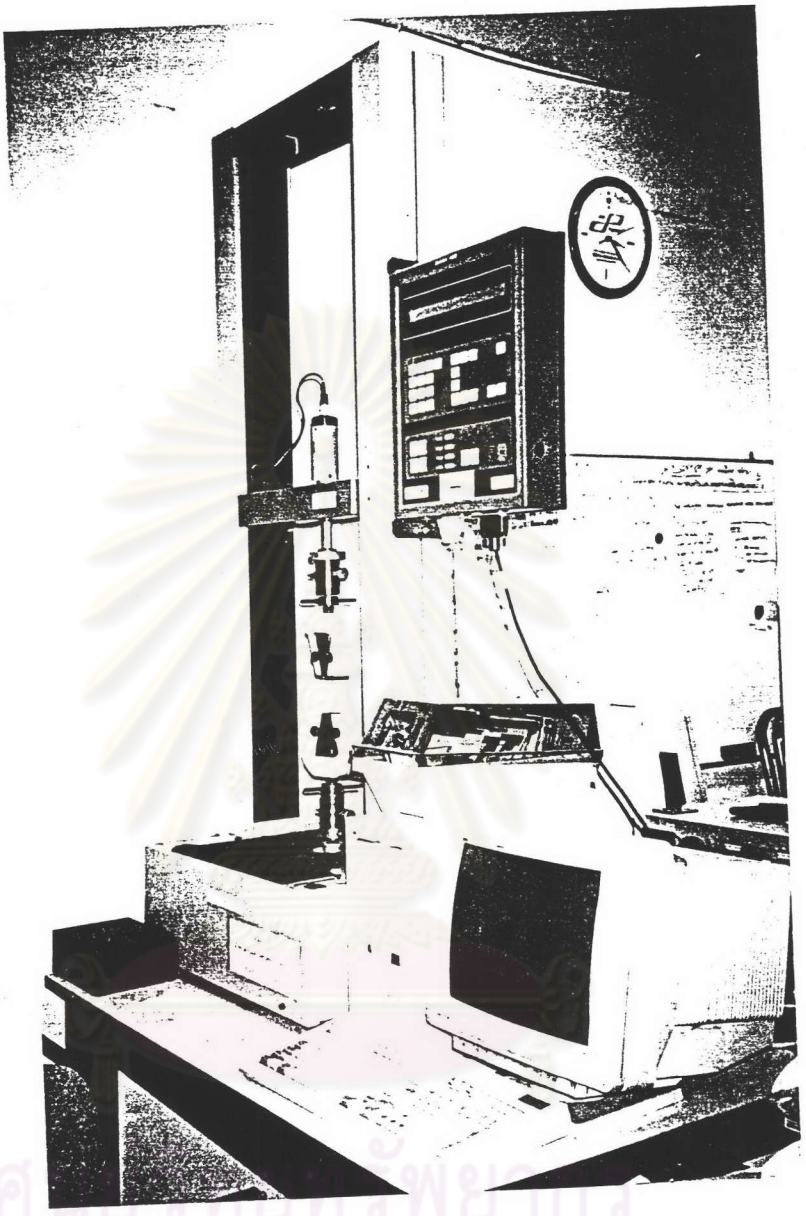

FIGURE 5.5 Tension machine

these same dimentions may also be cut from large. The bonded panels shall be cut into 25mm (1 in.) wide test specimens by a mean that is not deleterious to the bond. the 76 mm (3 in.) long unbonded ends shall be bend apart, perpendicular to the glue line, for clamping in the grips of the testing machine. At least ten test specimens shall be tested for each adhesive.

Condition specimens for 7 days at a relative humidity of 50 $\pm$2% at 23$\pm$1 $^{\circ}$C, except where the adhesive manufacturer may specify such an aging period to be unnessary or a shorter period to be adequate.

Clamp the bend, unbonded ends of the test specimen in the test grips of the tension testing machine. Apply the load at a constant head speed of 254 mm (10 in.) /min. During the peel test make an autographic recording of load versus head movement or load versus distance peeled. Determine the peel resistance over at least a 127 mm (5 in.) length of the bond line after the initial peak.

The report shall includ complete identification of the adhesive tested, including type, source, manufacturer's code number, batch or lot number, form, etc., Complete identification of adherends used, including material, thickness, surface preparation, and orientation. Description of bonding process, including method of application of adhesive, glue-line thickness, drying or precuring conditions . Complete description of the test specimens, including dimentions and construction of the test specimens, conditions used for cutting individual test specimens, number of test panels represented, and number of individual test specimens. Type of test machine and crosshead seperation rate used.