Studies on the Particle Board

Report 5 ; Influences of Press-time on Thickness and Cleavage Strength of Particle Board.

Wood Physics, Section II

Takamaro MAKU, Ryozo HAMADA and Hikaru SASAKI

(Received December 5, 1958)

In this report, it was investigated and discussed how the initial moisture content (the moisture content before hot-pressing) influences on the relation between the press-time and the curing of binder.

The grade of curing of binder was decided by the following two tests ;

1) the thickness stability of board,

2) the cleavage strength of the central layer of board.

I Experimental Procedure

1) Board preparation

The particles used in this experiments are the same one as that for G-type in Report 4,[1] and they were conditioned to bring the final moisture content before hot-pressing to 11, 14, 18.5, 20, 22.5 and 25.5% respectively.

The binder used was a commercial urea resin (55% concentration) and was applied at dry solid weight 6% of dry particles and as hardener NH_4Cl 10% solution was mixed to the resin (8% dry weight/55% urea resin). The particles were sprinkled into a 17×17 cm forming-box to a mat, and hot-pressed to 20 mm thick at 135°C.

2) Measurement of thickness of board

After the predetermined press-time, the board was taken out and cut into twelve test specimens of 5×2×2 (thickness) cm. Then, without delay, their thickness was measured to 1/100 mm by micrometer.

3) Cleavage test of board

After measuring the thickness, the specimen was readily cooled in an ice-box, made a groove (4 mm wide and 15 mm

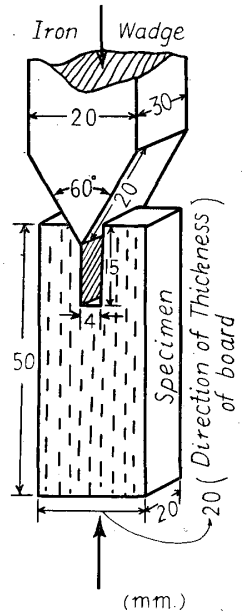

Fig. 1. Cleavage test.

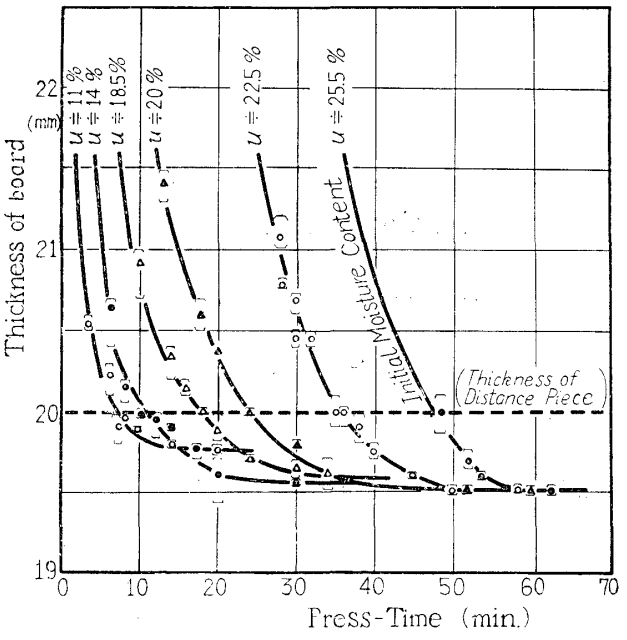

Fig. 2. Relation between initial moisture content and thickness behavior of board. (G-type, spec. gravity 0.65)

mm thick (thickness of distance piece) between hot-plates, but by further hot-pressing the board shrank down to an final thickness which was 0.2~0.5 mm thinner than the distance pieces and this may be caused by the drying and compression-shrinkage of board or the plasticizing of particles.

The figure shows that the lower the initial moisture content is, the shorter the hot-pressing time when the thickness of board reaches the final (stabilized) thickness is and the smaller the further shrinkage is. And this result can be supposed from the result in Report 4[1] that the lower the initial moisture content is, the faster deep) and then tested by the wadge as shown in Fig. 1.

The cleavage strength was calculated by following formula :

$$\text{Cleavage Strength} = \frac{\text{Maximum Load}}{\text{Cleavage Area}} \ (\text{kg/cm}^2)$$

II Experimental Results

1) Relation between press-time and final thickness of board

Fig. 2 shows the results of the thickness measurement of the boards of different initial moisture content.

Generally it took about a minute to compress the particle mat to 20

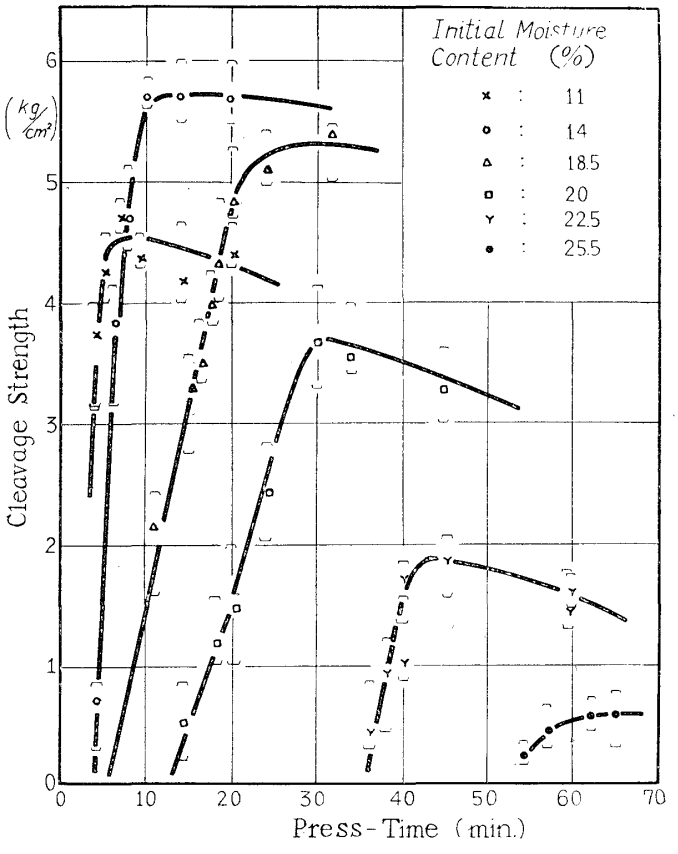

Fig. 3. Relation between cleavage strength and press-time. (G-type, spec. gravity 0.65, board thickness 20 mm)

the inner temperature rising and drying of board are and may be a good indicator for deciding the hot-pressing time.

2) Relation between press-time and cleavage strength of board

Fig. 3 shows the relation between the press-time and the cleavage strength of the central layer of board. In this figure, it is recognized that the cleavage strength increases suddenly with the press-time, and then after reaching a maximum value it falls down gradually and the higher the initial moisture content is, the later the time when the strength reaches a maximum value is. And the maximum value is highest at about 14% moisture content.

As there are few reports on the relation between initial moisture content and the cleavage strength, Kollman[2] informed that the cleavage strength can be increased by means of rising the initial moisture content of face layer more than that of core.

These above obtained results are summarized and shown in Fig. 4 as the relation between the initial moisture content and the press-times. In this figure the result on the temperature in Report 4[1] is also shown for references.

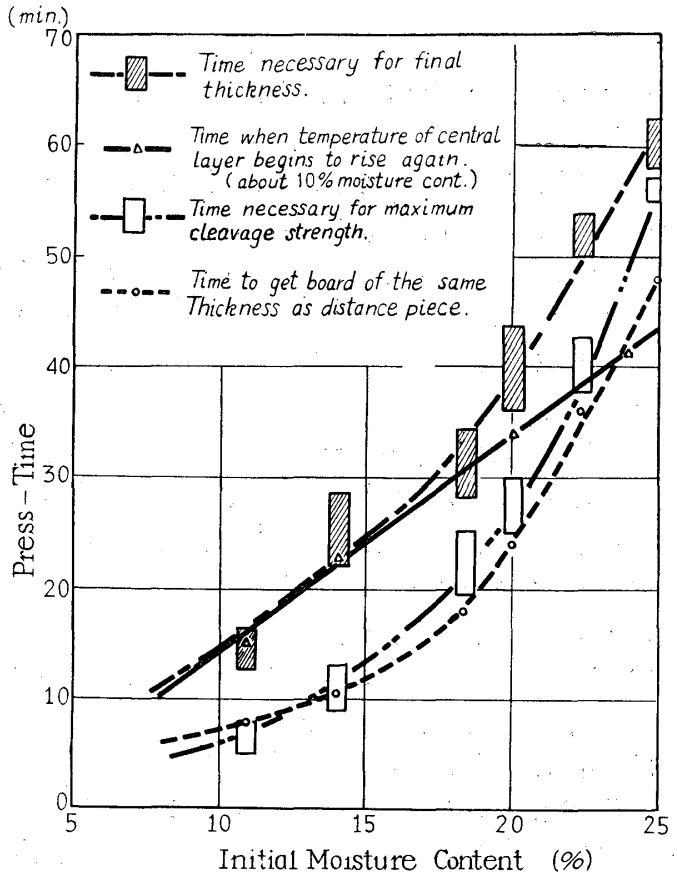

Fig. 4. Relation between initial moisture content and press-time. (G-type, spec. gravity 0.65, board thickness 20 mm)

III Summary

These results are sumarized as follows :

1) The hot-pressing time to get the board of the same thickness as the distance piece increases with increase of the initial moisture content of particle mat (Fig. 2).

2) And by further hot-pressing, the board settles its thickness which is 0.2～0.5 mm thinner than the distance piece, and the time necessary for final thickness is longer of higher initial moisture content (Fig. 2).

3) The cleavage strength increases abruptly with the press-time, and after it reaches a maximum value it decreases down gradually. And the higher the initial moisture content is, the longer the time for maximum value is. And the highest strength can be acquired at the initial moisture content about 14% (Fig. 3).

4) These results are summarized and shown in Fig. 4 and the results of temperature measurement in Report 4 are shown together for reference.

摘　　要

パーティクル・ボードの熱圧時間と結合剤の硬化度の関係を種々の圧締前含水率について検討した。

硬化の判定は種々の初期含水率に調整されたボードの任意の熱圧時刻に於ける厚さ及び中心層の剝離強度の測定結果から行つた。

パーティクルは第4報のGタイプ用のもの（通気性粒状）で予め種々の含水率に調整しておき，尿素樹脂を気乾パーティクルの6%添加した後の含水率を夫々11, 14, 18.5, 20, 22.5, 及び25.5%にした。これ等を17×17×2（厚さ）cm になるように135°Cの熱板で圧締した。

任意の熱圧時間後にとり出したボードからすばやく5×2×2（厚さ）cm の試験片12ケを切り出し厚さをマイクロメーター（1/100 mm）で測定し，直ちに氷箱中で急冷して後 Fig. 1 の如き切り込みを入れて楔による割裂強度を測定した。

これ等の測定結果を要約すると次の如くである。

1) ディスタンス・ピースと同じ厚さのボードを得る為の熱圧時間は初期含水率（パーティクル・マットの含水率）の低いもの程短い (Fig. 2)。

2) 更に熱圧を続けると厚さは 0.2～0.5 mm 収縮し安定した最終厚さに落着く，この時刻も熱圧前の含水率の高いもの程おそい (Fig. 2)。

3) 中心層の楔による割裂強度は熱圧時間と共に急激に増加し，或時刻で最高値に達し，それ以後は漸次低下してゆく。この最高値に達する時刻は熱圧前の含水率の高いもの程おそい，そして各々の最高値の中熱圧前の含水率が約14%程度の場合が最も高い値を示し，20%以上では実用に供し難い値に下がる (Fig. 3)。

4) これ等の諸関係を Fig. 4 に総括的に示したが同図には参考迄にレポート4で測定したボードの中心層の含水率が約10%に乾燥される時刻も記載してある。

Literature Cited

(1) T. Maku, R. Hamada and H. Sakaki: (Report 4) Wood Research **21**, 34 (1959)

(2) F. Kollmann : Holz als Roh- u. Werkstoff **15**, 35 (1957).