PLASTIC STICKERS FOR THE KILN DRYING OPERATION

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This is the first time that I have been asked to give a paper as such. I have talked in front of many groups, but on subjects that I know more about than I do about kiln operation. If you will bear with me, I would like to start with a brief resume as to why we went into the kiln sticker manufacturing business.

We incorporated in the state of Oregon in early 1958. Most of our business until recently has been the manufacturing and sales of United States Coast Guard approved rescue equipment. I have owned and operated a boiler and engine room supply business; therefore, I have friends in the lumber industry, and I was approached at one time as to the possibility of fabricating kiln stickers, but of other than wood. It seems that on the longer kiln stickers, clear material is a must, and due to the fact that clear material is becoming scarcer and more valuable, the thought was put in my mind to attempt to come up with something as useful as the wooden sticker with a greater longevity.

I have spoken to some twelve kiln operators and kiln consultants as to the advisability of a substitute for the wooden kiln sticker. After much experimenting with various types of plastics, we feel the reinforced fiberglass kiln sticker is the most desirable. We have experimented with high impact styrenes, high density foams and metals, and through our tests we feel that the fiberglass sticker is the most adaptable. Our original fiberglass stickers were made by hand lay-up, giving us a very desirable surface on three sides, but we could not get enough compression on the fourth side to make a perfect sticker. However, we did manufacture ten of these stickers 9/16" thick by 1 1/2" wide x 9'2" long and asked one of our friends in the kiln business to use and abuse the sticker as much as possible. I am pleased to say that all but two of the stickers are still in service and have gone through the kiln 200 times or better, showing no appreciable wear, as demonstrated by the sticker that I have here with me.

With our particular lay-up we find that our stickers will withstand temperatures up to a plus 300° F. with no deformation. For special applications we can adjust our formulation to withstand up to 500° F. One of the tests we performed at our plant was as follows. We took a 9/16" x 1 1/2" x 9'2" bar and secured it down two feet from the end. Then, arranging an eccentric, we raised the end 8" and let it snap back a total of 1200 times, showing us that we had the flexual strength and ruggedness we feel is essential in this type of operation.

Although I have implicit faith in engineering knowledge, I also feel that actual application gives, at times, better results than laboratories. Under actual operation these stickers have been deflected vertically and horizontally, but when the pressure has been removed, the stickers come back to their original shape. There have been various opinions offered me regarding the dimensions the stickers shall be. I have received opinions on 3/8" x 3/4" to 3/4" x 2" stickers. The length, of course, will be regulated by the width of the stickers going into the kilns. It seems to me, who knows nothing about this operation, that the thinner the sticker is, the more load can be placed in the kiln at one time. We have evidence that where one particular company went from the 9/16" to 3/8" sticker for test purposes, they were able to place 10% more lumber in the kiln at one time; however, it did extend the drying time somewhat. As you gentlemen know, the satisfactory operation of the kiln is dependent on the heat and c. f. m. through a properly stacked and baffled load. With the use of the fiberglass stickers we have found there is no discoloration to the lumber and no more perceptible compression than with the use of wooden stickers. The fiberglass stickers will hold their original shapes more readily than the wooden stickers because, I have been told that a new 9/16" wooden sticker after the first or second pass through the kiln ends up being a 1/2" sticker, approximately. The fiberglass stickers, properly manufactured, will have a dimensional tolerance of plus or minus 1-1000th of an inch. This is due to the fact that the saturated fibers are drawn through two shaping dies and one curing die.

Now for a little information regarding the glass and the resins. The glass used in the fabrication of the kiln stickers is commonly known as "yarn". It has the same properties basically as window glass, except for the fact that after manufacture the filaments must be treated to properly accept the resins. I have been told that a glass marble the size of a child's mig extruded would furnish a filament that would circumvent the globe. We have here some samples of the glass that are used in our fabrication, and each sample constitutes one strand of yarn. In the 9/16" x 1 1/2" sticker there are 161 strands of yarn. These samples are for you to look at and take home if you so desire, but you can see that each individual filament is both strong and flexible. In this operation, we do not worry about the tensile strength of the piece. The only worry we have is the compression and flexual strength. Before inducing the 161 strands in the curing dies, they are wetted and wrung out three different times to be sure that they are 100% saturated.

The comparatively recent appearance of polyester resins on the American and European industrial scene has wrought something of a technological revolution. Projection capacity has had to be continually expanded and diversified to cope with a steeply rising demand for new materials and projects, each endowed with properties predetermined to meet widely diverging but ever more stringent requirements. The spectacularly successful application of polymerized, unsaturated polyesters to such varied practical ends is largely due to the great variability of the polymer structure.

The polyester backbone is generally composed of three basic types of structural units, saturated acids, unsaturated acids and glycols. In the case of the general purpose polyester, these components usually consist of phthalic acid, maleic acid and propylene glycol, to which diethylene glycol is occasionally added in small amounts. This is a very desirable composition, since it has the characteristics of low cost and good quality; propylene glycol and phthalic anhydride are the lowest cost raw materials in their class. Maleic anhydride does not appear to have a competitor other than its isomer fumaric acid, at least there does not seem to be another unsaturated dibasic acid that can match both the cost and quality of these two isomers.

Expedience is a very basic function in using these three types of raw materials to build the polyester chain. The unsaturated acid provides the sites for cross-linking, the saturated acid determines the degree of spacing or concentration of the usaturated acid molecules along the polyester chains, and the glycol, of course, provides the means for esterification and for bridging the acids to form a polymer.

It is most fortunate that unsaturated monomers such as styrene can be added to polyesters so that they not only can act as solvents but also copolymerize with the unsaturated groups along the polyester chains. Methyl methacrylate, too, has been shown to react with the fumarate groups in the model resin system polyethylene fumarate-methyl mathacrylate at nearly identical rates to those prevailing in the ordinary homopolymertization of pure methyl methacrylate. In most commercial polyesters styrene is employed as the main component. This is largely due to both its low cost and the characteristic of high quality it imparts to cured polyesters.

I know I am going to be asked in the question and answer period the cost of these stickers. Based on a comparative original price between the wooden and the glass stickers, in the long run the glass sticker will cost fractions of a penny per pass through the kilns. At the present time we are endeavoring to reduce the weight, which in some instances may have a bearing on the operation. These stickers will be imprinted with our customer's name or insignia if desired. It is possible for us to color impregnate the resins for a desirable or outstanding color. Our standard color will be that you have in your sample.

Since we are rather new in this field, we have made arrangements with your good friend and ours, Bob Baynham, to represent us in sales in your field. If we can be of any further service, please don't hesitate to call on any of us.

<u>Load-Deflection Tests Performed on One Plastic Bar</u>

<u>Test Number 1:</u>

Width:	1.575"
Thickness:	0.650"
Span:	24"
Center Point Load at 2" Deflection:	520 Lbs.
Modulus of Rupture:	28,131 p.s.i.

<u>Test Number 2:</u>

Width:	0.650"
Thickness:	1.575"
Span:	24"
Center Point Load at 2" Deflection:	835 Lbs.
Modulus of Rupture:	18,642 p.s.i.

<u>Test Number 3:</u>

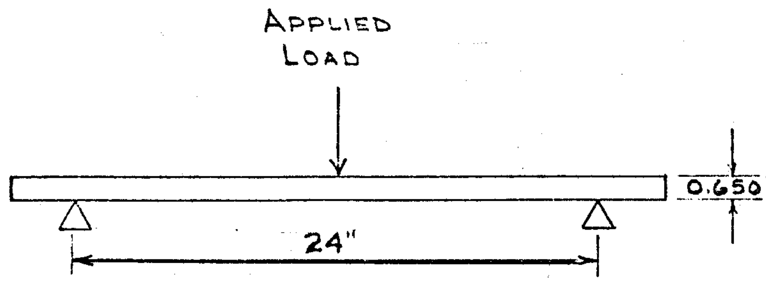
Width:	1.575"
Thickness:	0.650"
Length:	4"
Compressive Strength:	51,400 Lbs.
Deflection:	0.4"

<u>Test Number 4:</u>

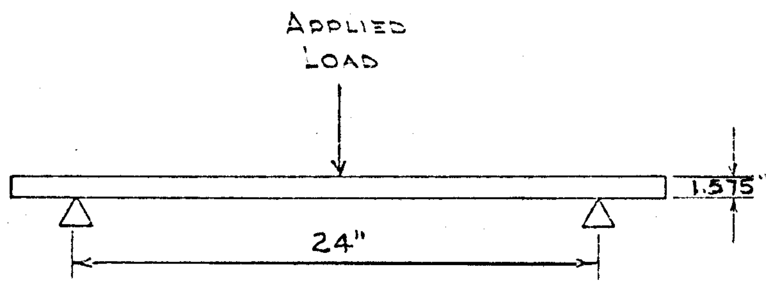
Width:	0.650"
Thickness:	1.575"
Length:	4"
Compressive Strength:	9,550 Lbs.
Deflection:	0.04"

Portland Industrial Plastics

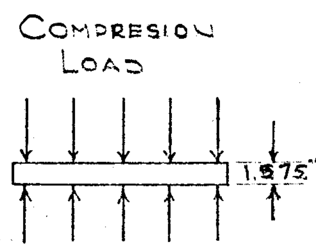
Test #1



Test #2



Test #3



Test #4