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by

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At the request of Central Mortgage and Housing Corporation, the Division of Building Research has carried out some experiments for the purpose of evaluating two proprietary materials which are designed to stop active leaking of water through concrete. These will be referred to as material D and material E.

The manufacturers of material D claim that their product is a quick-set hydraulic compound which, when mixed with water to a putty consistency, will harden quickly and seal out active water; that is, the material will prevent water from flowing through a crack or hole even when that water is under a head.

Material E, according to its manufacturer, will harden in five minutes and stop the flow of water under a head. It is also claimed that E can be used for anchoring bolts in concrete and as a patching compound. Both D and E are sold in powder form, ready for mixing with water.

Materials D and E may contain chemical agents to accelerate the set of the cement component or they may be mixtures of portland cement and high alumina cement, various combinations of which result in different setting times.

There are several requirements of a water-plugging material which should be considered. The first is its handling properties. The material should mix with water readily to form a smooth paste. Secondly, the material should set quickly and bond well to the walls of the hole or crack. The water-plugging material should also seal out water more or less permanently. Lastly, the durability is important only where the plugging material is exposed to weathering. As this is not usually the case, this aspect has not been considered experimentally.

It is important that the technique of plugging should be carried out according to the directions of the manufacturer. The crack or hole should be enlarged and cleaned out before applying the waterplugging compound, so that there will be sufficient surface for a good bond.

Both D and E mixed easily and set quickly, although material D did set more rapidly than E. It was also noted that D gave off a large amount of heat while E gave off very little heat during early hydration. Material E appeared to be more fragile after setting than material D.

Since the degree of shrinkage is so closely linked with the ability of a plugging material to stop water permanently, it was considered important to base the conclusions as to its efficiency, at least in part, on the volume changes occurring during and after setting.

It was impossible to measure volume changes during setting. It was possible, however, to begin measurements 20 to 30 minutes after moulding.

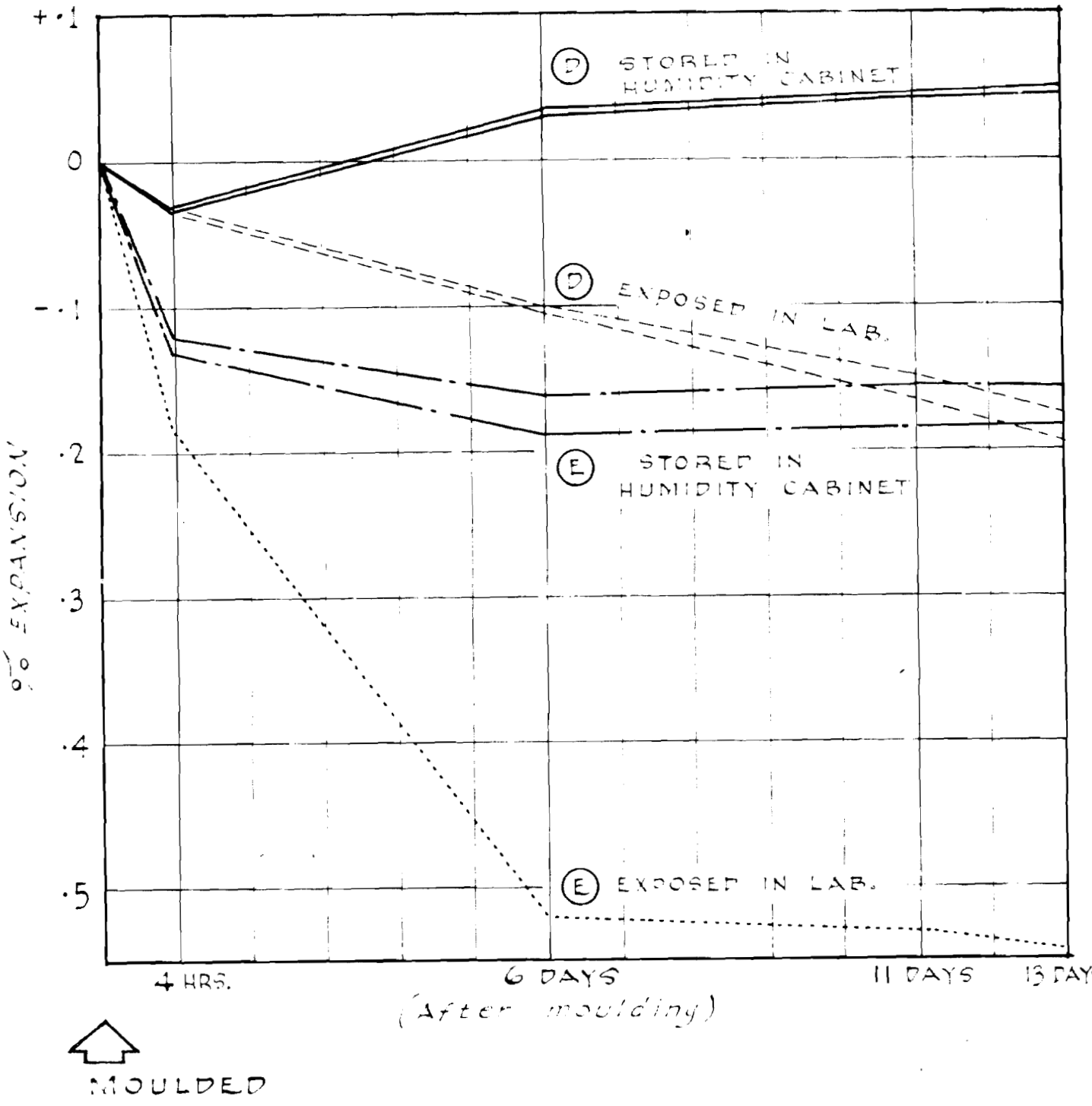
To measure these changes, bars 1 by 1 inch with an effective gauge length of 5 inches were moulded with a measuring stud at each end. Four bars each of materials D and E were moulded.

The bars were removed 20 to 30 minutes after moulding and measured immediately in a comparator. Four hours later two bars of each material were placed in a humidity cabinet at 76°F. and R.H. 100 per cent. The remainder were exposed to laboratory conditions of approximately 75°F. and R.H. 30 to 40 per cent.

The results are shown graphically in Fig. 1. Material D showed a shrinkage of 0.033 per cent four hours after moulding. Material E contracted 0.130 per cent in the same time. After two weeks in the humidity cabinet material D had expanded 0.046 per cent and material E had shrunk 0.170 per cent. Two weeks exposure to laboratory conditions resulted in material D shrinking 0.164 per cent while material E had shrunk 0.544 per cent.

Conclusion

It would appear from these results that material D is superior to material E for the purpose of plugging water leaks permanently since the shrinkage of material E is considerably greater than that of material D. It was also found that material D sets a little more rapidly than material E. Both materials appear to be capable of stopping the immediate flow of water when applied as directed by the manufacturers. The permanency of the seal was not tested, nor was the durability evaluated because of the long-term nature of such tests and because these materials are most often used where they will not be exposed to weathering.



NOTE:
NEGATIVE EXPANSION INDICATES SHRINKAGE

VOLUME CHANGES EXHIBITED BY TWO PROPRIETARY WATER PLUGGING MATERIALS