phenol-formaldehyde film (Tego) and in plywood bonded with an aqueous dispersion of cold-setting urea-formaldehyde resin (Uformite CB551):

(a) Fatigue failures are primarily wood failures.

(b) Delamination of the veneers occurs very seldom before the outer plies have given way.

(c) The material may be expected to withstand at least 2,000,000 stress reversals without failing, when stressed to 25 per cent or less of the static modulus of rupture.

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BIBLIOGRAPHY


Discussion

M. Finlayson. Were load-deformation curves taken after the material had been stressed through a large number of cycles, in order to determine whether or not the load as well as the deflection was constant throughout the test? It is suggested that either load-deformation curves at various stages of the test or a load indicator on the machine would show whether or not the load remained constant throughout the test, a point which might have some significance, especially at high loads or over a large number of cycles.

J. E. Gurvitch. It may be well to add to the information in this paper that results obtained by A. L. Crocker, on the fatigue strength of compreg (compressed laminated resin-impregnated wood), and the writer, on the fatigue strength of various glue lines on compreg, are in line with the work done by the authors. The fatigue strength of compreg was found to be 11,000 psi, approximately 23 per cent of the modulus of rupture of this material (40,000 to 50,000 psi). Compreg could be stressed with that load for several million cycles without failure. Fatigue failures were also similar to those described in the paper. After the initial crack developed in the outer ply of the compreg, the line of failure often followed the glue line between the outside and the adjacent ply.

The fatigue resistance of various glues, i.e., casein, urea formaldehyde, and phenol formaldehyde, were tested for fatigue strength by gluing thin compreg laminations (8 in.) together with each of the glues mentioned. These laminated beams were subjected to 11,000 psi for a minimum of 7,000,000 cycles. No failures occurred in the glue lines of any of these adhesives. Controls were given an accelerated aging test by heating at 65 °C for 1 month and then fatigued for 7,000,000 cycles at the stated stress. No failures were observed.

All fatigue tests were made on compreg specimens 1/8 in. × 1/8 in. × 11 in., the direction of grain being parallel to the longer dimension. A cantilever system was used in which the beam was held stationary at one end and flexed by a cam mounted on an electric motor.

In all tests, it was noted that the specimen generated heat at the point of maximum stress. No quantitative measurements were taken, however, of the temperature rise.

P. D. Zottu. Did the authors observe any differences between the specimens tested which were bonded with urea- and phenol-formaldehyde glues?

AUTHORS' CLOSURE

Load deformation curves were not taken on the test specimens after being stressed to failure, inasmuch as the type of failure generally precluded such measurements. In a subsequent series of tests, in which tests will not be carried to failure, it is intended to make load-deformation measurements both before and after repeated stress.

The tests on compreg reported by Mr. Gurvitch are very interesting in that they indicate the behavior of compressed impregnated wood under repeated stress to be similar to that of plain wood and plywood.

There was no significant difference in the behavior of phenol-formaldehyde bonded material as compared with urea-formaldehyde bonded types.

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