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7th Volume

Jerome M. Klosowski

Editor

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Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing: Seventh Volume

Jerome M. Klosowski, editor

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Foreword

This publication, *Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing: Seventh Volume,* contains papers presented at the Seventh Symposium on the Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing held 14-15 January 1998 in San Diego, California. The symposium was sponsored by ASTM Committee C-24 on Building Seals and Sealants. The symposium chairman and editor was Jerome M. Klosowski, Dow Corning Corporation, Auburn, Michigan.

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Overview

This book captures papers from the Charles J. Parise Seventh Symposium on the Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing. The overriding theme behind the papers is durability. This topic is fundamental to all users and specifiers of sealants.

When this editor polled several sealant contractors to ask how long they wanted a sealant to perform in a building, the answer was at least 5 years. When architects and specifiers were asked the same question, the answer was between 10 and 20 years unless they were talking about structural glazing and then they wanted the sealant to last even longer. What the answers had in common was the comment that they knew of nothing in the ASTM standards for sealants that addressed the longevity issue. They were, of course, correct in that most tests address as-cured performance or some aspect of performance after a short period of additional environmental stress. Nothing yet on the books addresses the long-term performance they are looking for. Thus, the many papers here that address the more stressing situations will be of interest to most readers interested in sealants.

The first set of papers in this book addresses the topic of stress and fatigue. The Lacasse, Margeson, and Giffen papers discuss temperature changes and fatigue. It seems impossible yet it is true that most people who design joints and specify sealants do not have hard data on typical temperatures in the joint and on the buildings and the extent of movement in the joint caused by these temperature changes. Movement is, of course, a key cause of failure, and the extent of the movement and especially movement during the cure process is critical. This must be known, and the effect of movement and repeated movements (fatigue) on the longevity is a critical issue in durability.

Joint designs vary from the square section to exaggerated hour-glass shapes. The joint designs are factors in the longevity of a sealant in the joint. This was addressed by the Tanaka paper.

Klosowski (this editor) summarized the available work on accelerated weathering tests and how that relates to the damage caused by real weathering. The take-home message from that paper is that any artificial weathering will require at least 5000 hours in the test machines to begin to approach the damage seen outdoors in 5 years in the sun. This means that all the tests presently in use today, except for structural glazing tests, don't stress the sealants nearly long enough to be good indicators of longevity in the real world. The strong suggestion is that designers and specifiers should demand more rigorous test exposure, longer exposure times before the sealants are stressed in tension and compression and rated on durability. The alternative is to stress the sealants in tension and compression while they are weathering. Either way, good predictive data can be obtained only with long-term testing in the weathering machines. Short-term tests simply have no value. This and other aspects of weathering are discussed.

The paper by Boettger and Bolte of the University of Leipzig reinforces the above position. They make a strong statement that there must be movement or stresses during the artificial weathering to represent more closely the real damage seen to sealants on real buildings. They present data of a research study in process which is informative. The completion of their work should lead to more realistic tests of sealant durability if the industry accepts the idea of having more realistic tests.

Demarest and Dione demonstrated in their paper that acrylic latex sealants can come in many qualities and that some can be formulated to have properties that approach and in some cases match some of the chemically curing sealants. There is yet another message in their paper, which also appeared in the Klosowski paper, the thought being that there are better and poorer qualities in specific products in each of the generic types of sealants. The clear implication is that the buyer must beware and look for test data that support the claims of performance and should buy only those products that can provide data to support their claims—some latex acrylics are a cut above the other latex acrylics.

Paul Johnson took a different approach in sealant selection, looking to the unique sealant applications in roofs and doing the old fashion listing of the performance needed for each application.

Destruction of a joint can be more than a failed sealant. It can be a fine sealant in a joint that is picked clean by birds. This topic was addressed by Chin and Sass, who offered innovative solutions to this sometimes perplexing problem.

Destruction of weather protection offered by sealant, the diagnosis of the cause and solutions, especially in EIFS systems, was discussed in several papers. The paper by Uhlman addresses failures, causes, and cures as does the paper by Ken Yarosh. EIFS provides a very fragile surface for adhesion, and thus the lower modulus of the sealant used in the sealing the greater the chance for success. However, in some cases even that is not enough. For some problems a very workable solution is the use of preformed sealant strips that are glued over the joint. If the strip is also low in modulus, that provides a very attractive alternative sealing method. While simple intersection seemed to be handled easily by overlaying the sealant strips, there are some quite complicated intersections. One way to do these is with molded parts. The preformed sealant concept was handled in a paper by Hagen, Klosowski, and Mayville; in a paper by Kelly McBride, in a paper by Chen, and in a paper by Brown. Some of these papers also covered preformed, molded corners.

The esthetic concerns of fluid migration from sealants and sealant staining potential were addressed by Gorrell, Chin, and Scheffler and by Snyder, Badour, Carbary, and Wolf. Not all silicones stain, nor do all slow-curing urethanes bleed, but some do. The very interesting conclusion is that staining and fluid migration can be caused by each of the generic classes of sealants, and one must look at the individual sealant and the specific tests used to make intelligent choices.

Relative to sealant testing, the paper by Nick Shephard of work done at V.P.I. on adhesion testing is a landmark paper. It has little value to the sealant user, but there is little doubt that the sealant designer will adopt this technique to study adhesion durability. It consistently produces adhesive failure, which is the ideal tool for studying adhesion.

Some excellent papers on finite element analysis are presented by Gase, Hudacek, and Pesevski and by Carbary and Travis. These show where the stress concentration starts and maximizes in various joint designs and provides the basis for better joint design and better joint geometry.

The Steve Block paper also addressed joint geometry, but now in the glazing beads. Here the glueline thickness is often small and the thermal stresses large. An awareness of this problem is the first step toward designing better joint geometry in the glazing bead and having longer-lasting glazing seals.

There is a concluding series of papers that address a variety of topics. Oba and Partl address the adhesion of waterproofing membranes; Ackerman looks at firestopping from a latex viewpoint; Sherrer looks at polysulfide sealants for chemical containment; and a final paper by Yanoviak and Yanoviak looks at the myriad of places sealants are used in modern buildings and spaceframe structures.

While the papers are interesting and stimulate thought, this is but one in a series of STPs by members of ASTM Committee C 24 on Building Seals and Sealants that address these topics, and all are related to durability. The evidence is starting to mount, and science is validated in many areas, that durability can be better tested and joints better designed. ASTM and ISO should use these data to design new durability tests that more closely simulate the real world—real performance tests.

The finite element techniques should be used to design new joints that have lesser stress concentration points, less fatigue, and are thus more prone to allow the sealant to seal successfully for long periods of time.

The adhesion test that consistently produces adhesive failure is fundamental to advancing the sealant science. We have waited a lifetime for it, and now we should use it.

In essence, this is an excellent collection of scholarly papers, but they will have little value until you, the reader, apply them in practical applications and advance designs and incorporate this work into your thinking. Then the industry will advance and buildings and structures will last longer and be more functional because the sealants are doing their job for as long as they are supposed to. That is the ultimate definition of durability material: ''doing what it is supposed to do for as long as it is supposed to do it.''

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