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Publisher *Taylor & Francis*

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The Journal of Adhesion

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713453635>

An Appreciation of David A. Dillard

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Online publication date: 10 August 2010

To cite this Article Ward, Tom and Dillard, John(2010) 'An Appreciation of David A. Dillard', *The Journal of Adhesion*, 86: 7, 671 – 674

To link to this Article: DOI: 10.1080/00218461003788546

URL: <http://dx.doi.org/10.1080/00218461003788546>

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| An Appreciation of David A. Dillard

BACKGROUND

David A. Dillard was born and raised in Missouri, and graduated from the University of Missouri-Rolla with BS (1976) and MS (1978) degrees in Engineering Mechanics. Initially, he worked as an engineer for the McDonnell Aircraft Company. Following this, Dr. Dillard earned his Ph.D. degree at the Virginia Polytechnic Institute and State University (Virginia Tech) in 1981. His dissertation “Creep and Creep Rupture of Laminated Graphite/Epoxy Composites” was completed under the direction of Professor Hal Brinson. David began his academic career as an Assistant Professor in the Department of Engineering Science and Mechanics at Virginia Tech in 1985. In his academic career at Virginia Tech he rose rapidly through the professorial ranks to be recently appointed as a Commonwealth Endowed Professor. Along the way, Dave served as the Director of the Center for Adhesive and Sealant Science, and he was a founder and Interim Director of the Macromolecules and Interfaces Institute at Virginia Tech. He has also served as Vice-President and President of The Adhesion Society and is a Patrick Fellow of the Society. He is a member of the Advisory Board of *The Journal of Adhesion*.

As the Adhesive and Sealant Science Professor in the Engineering Science and Mechanics Department at Virginia Tech, David has worked extensively in the field of adhesive bonding, using his experience in structural adhesives for aerospace, automotive, and infrastructure applications. His interests broadened over the years to include adhesives and coatings for microelectronic applications, pressure sensitive adhesives, and elastomeric adhesives and sealants. Sharing his knowledge, Dave has coauthored 140 publications in refereed journals, and he regularly teaches courses in adhesion science, polymer viscoelasticity, and sustainable energy solutions. A critical and highly praised aspect of his research involved developing test methods and predictive models for understanding and estimating the performance and durability of adhesives and bonded joints using the principles of fracture mechanics and viscoelasticity. Over the past several years he has become active in applying these concepts to “green” energy products including PEM fuel cells.

RESEARCH

For more than 30 years, Dr. David Dillard has been making contributions to the field of the mechanics of adhesion. He recognized early in his research that the control and understanding of surface and polymer chemistry in such systems was essential for meaningful results. Thus, Dave's contributions have been seminal and instrumental in moving the field forward from an art to a science. His investigations published in scholarly journals have provided an understanding of fracture, durability, and performance in bonded joints not only to those focusing on the mechanics of joints but also to those concerned with the chemistry of the adhesives and of the bonding surfaces. Dave recognized early that all of the efforts in chemical synthesis and formulation chemistry are diminished without a comprehensive understanding.

Dave's contributions have been elegantly designed, convincingly executed, and timely. In particular, Dave consistently has been able to clearly, simply, and elegantly explain: 1) why his recent discoveries are important, 2) what will likely be the most significant long-term impact of the research completed, 3) where the logical future developments will arise, and 4) how others might immediately incorporate the new results into their own investigations.

Direct quotes from several of the Dave's nominators for the 3M Award follow:

"Professor Dillard's research activities cover a wide range of topics related to the mechanics of adhesives, and he brings an exceptional level of clarity and creativity to all his work. Another important area addressed in Prof. Dillard's research is test method development. This topic is often ignored by researchers despite the fact that it is critical to all applications of mechanics in adhesion. His papers on the 'blister test,' 'mixed-mode failure,' and 'joint durability' are seminal contributions in adhesion science. His most recent exciting and novel contributions on the failure of adhesive joints under high-rate testing also demonstrate the extent of Professor Dillard's contributions. Professor Dillard is one of the few people who can present stress analysis results in terms that non-mechanics people can understand. The absolute clarity of his writing has made it possible for those not originally trained in mechanics (e.g., chemists) to learn and understand the crucial role of mechanics in performance."

"His research contributions have introduced the concept of directing crack growth along a given interface as influenced by the surface chemistry of the substrate or the adhesive. The practice has been used to make predictions regarding the lifetime of adhesive bonds. He

has also offered new applications of various blister tests as a way of interrogating interfacial interactions and strain energy release rates in rigid and flexible bonded systems. The results have provided new insight regarding the manner in which the exposure environment influences crack propagation, propagation rate, and the debonding mode.”

TEACHING

Additional direct quotes from some of the Dave’s nominators for the 3M Award best summarize his selection for this honor:

“Professor Dillard has also been effective in instructing non-engineering individuals in the concepts and applications of mechanics to adhesive bonds. His efforts have allowed many chemists to dare to venture into the realm of mechanics and engineering. Because of his wide-ranging knowledge in mechanics and chemical concepts, and his practical knowledge regarding bonded systems, he is widely sought as a consultant and teacher in adhesion science.”

“Perhaps even more significant is the fact that Professor Dillard cares about the professional development of adhesion scientists and engineers, even if they are not directly connected to one of his own programs. In a professional meeting Professor Dillard had some remarkably insightful comments about adhesion testing and his suggestions led to a dramatic improvement in the reliability of the testing methodology. This knowledge and the fundamentally humble, unselfish, and instructive way in which he shared this information with his professional colleagues is representative of the manner in which Professor Dillard interacts with his fellow scientists.”

“It has been my good fortune to team-teach a graduate level course at Virginia Tech with David for over en years. Each of us participated in the other one’s lectures as observers and we offered comments that tied the two main topics of 1) mechanics and 2) experimental/modeling polymer viscoelasticity into a unified subject. Over all of this time, David consistently demonstrated that he is a superb lecturer . . . I learned a great deal from him, and our students indicated similar experiences to me. Also, I have taught innumerable short courses with Dave and his consistency of pedagogical excellence (regardless of the topic in adhesion science) is amazing.”

“He has made notable and significant contributions to the science of adhesion and has been a superb educator of others in that field. Rarely, one encounters a practitioner of truly innovative approaches to unanswered questions in science such as Dave Dillard.”

SUMMARY

Finally, direct quotes from several nominators' letters recommending Dave for the 3 M Award contribute to a perspective of this remarkable scientist:

"... Anyone who has read Dr. David Dillard's papers appreciates his clear thinking and straightforward writing. The overall motivation for his scholarly work is always made clear and compelling. Experimentalists appreciate the extremely clever arrangements of his experiments to eliminate confusing and extraneous factors. He embodies a uniquely well-balanced experimental and theoretical approach to a problem. The descriptor, "excellence," does not do justice to the significance of the contributions made by Professor David A. Dillard. His body of work is superb, and the Award for Excellence in Adhesion Science Sponsored by 3 M is a fitting recognition..."

"In my view Prof. Dillard is the world's leading authority on the mechanics of adhesive bonding, and he has played a leading role in the application of mechanics approaches to problems in adhesion science. Much of his work has been very influential in my own research, so I have first-hand knowledge of the depth of his contributions."

"Professor David Dillard's resume of accomplishment 'speaks for itself' in terms of students graduated, papers published, and completed projects. He is now at the peak of his productivity and will continue to generate outstanding and innovative accomplishments for years to come... His presidency of the Adhesion Society, his Directorship of the VA Tech Center for Adhesion Science, and his general support of committees, students and colleagues is strong and consistent. Dave is a solid citizen of the Adhesion Community as a whole."

Submitted by

Tom Ward and John Dillard, Virginia Tech
January 2010