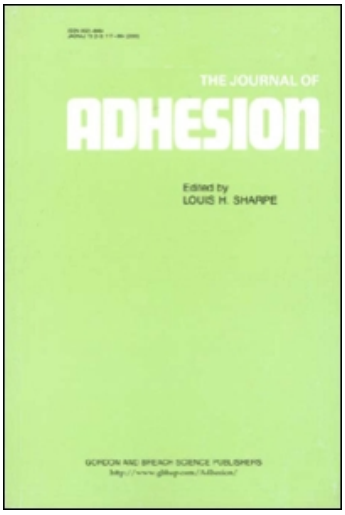

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Keynote Address 2nd Annual International Symposium on Adhesion and Adhesives for Structural Materials

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Keynote Address 2nd Annual International Symposium on Adhesion and Adhesives for Structural Materials

As keynote speaker for this 2nd Annual International Symposium on Adhesion and Adhesives for Structural Materials, I would like to extend a welcome to all the attendees. Your presence here this morning indicates a vital interest in structural materials and the rapidly developing technology of adhesives. Certainly the international aspect of this meeting is very much in evidence—both in the participation on the program and in the attendance.

Major advances are being made in the design and use of structural materials, and more and more of these materials are assembled today with adhesives. As a modern society, we constantly use composites that are joined together by means other than rivets, screws, or nails—whether we use hot melts, pressure sensitive adhesives, anaerobically cured compositions, or thermosetting adhesives depends on the application and environmental exposure of the structural composite.

While the phenomenon of adhesion is easily observed—understanding its theory is not that straightforward. Hydrogen bonding, valence bonding, covalent bonding, and dipole-interaction are some of the definitive terms used to hypothesize why unlike substances can be joined together. During this symposium, we will hear about variables in predicting adhesion.

In assembling adhesive-bonded composites, tack developed by the adhesive plays an important role. Tack is defined as the quality or state

of sticking or adhering. Both the theory and practice of tack will be described this morning. We still are looking for a formulation that will provide inherent tack for EPDM rubber. Finding such a formulation remains a challenge for chemists if we are to use EPDM tires on our automobiles soon.

This morning I would like to focus on three key issues that concern designers, manufacturers, and users of structural materials—whether these materials are made of wood, plastic, or metal. These issues, which will be significant in the 1980's, are energy, environment, and the advancement of technology.

Before I discuss the energy issue I would like to take a few minutes to explain what might appear to be an inconsistency in the outlook for this issue. I don't believe any trend is permanent; however, the immediate economic condition is gloomy. Raw steel production has fallen 50% from January to June, 1982—and it is off 100% from a year ago—the lowest production since 1938. Castings output is down 30% from 1981—and 1981 was not a banner year!

Machine tool order backlogs have fallen from a high of $5.4 billion in January, 1981, to $1.7 billion in 1982. In the recession plagued steel, auto, foundry, forest product industry failures in the recession years is a fact—who would have forecast such a predicament for the mighty petroleum industry?

After setting a U.S. record in 1981, oil and gas drilling has plunged dramatically. In December of 1981 there were 4530 active drilling rigs in service and by the end of July 2700 were in service—which represents a decline of 40%.

While these facts and figures are dismal I do not believe this current trend is permanent. An economic revival is inevitable and positioned to occur in the spring of 1983. With recovery, energy availability again will become a major issue.

The global energy shortage is far from over. A ruinous new energy crisis once again could double or triple oil prices as it did in 1973 and 1979 and in the process batter economies and governments around the world, causing yet another period of price inflation. That chilling prospect is one of the predictions made by Daniel Yergin and Martin Hillenbrand in their recently published book "Global Insecurity: A Strategy for Energy and Economic Renewal." The present small glut in oil supplies already is lulling industrialized countries into complacency. The consensus of many in the science and energy fields is that the Reagan administration's alternative energy strategy is in

shambles and poses a serious long-term threat to us all. Oil prices will continue to inflate at a faster rate than other commodities; and in a crisis/conflict situation, shortages are predictable with their ruinous consequences.

With complete deregulation of natural gas scheduled for the U.S. by 1985, energy costs associated with its use will rise; and a substantial price increase in the principal feedstock of many chemicals—specifically formaldehyde—will occur. Consequently, the cost of basic chemicals used to make the plastics, resins and adhesives used in producing structural composites will be subject to price increases and potential shortages in this decade. Increased effort will be devoted to developing low energy manufacturing processes and to searching for and utilizing chemicals independent of oil or gas. That work is already under way in structural wood composites. Tree extractives, lignins, and furfural are among the principal wood-derived chemicals that will become useful and valuable substitutes. You will hear about these options during the next two days.

The environmental issue surrounding structural composites will be of prime importance to assemblers, manufacturers, and users over the next few years. The formaldehyde question as yet is unsettled. Emission levels are under attack in the wood industry, and more recently automotive foundry unions and textile unions have raised the issue. The substitution of high solids adhesives and water-based adhesives for solvent systems has received top priority as a consequence of health and safety issues surrounding exposure to solvents. The search for more environmentally acceptable adhesive formulations will intensify. More efficient adhesives that can be used at lower concentrations and cured at lower temperatures will be more highly valued in the future.

We will hear much more about cost/benefit or cost effectiveness in the future. Cost/benefit will become part of the discussion in resolving safety standards not only for drugs, pesticides and herbicides, but also for resins, coatings and adhesives which are coming under intense public scrutiny.

Emerging technologies is the third force affecting structural materials in the 1980's.

We should not expect to see the discovery of new polymers as much as improved utilization of those already in hand. Much more success will be forthcoming in the area of polymer alloying where the best properties of the composite derive from the additive properties of the individual components.

The formulation of systems where additives such as coupling agents and fibrous reinforcements contribute to improved performance will continue. As an example, stainless steel fibers in polycarbonate at levels as low as 1% of volume have been shown to be effective in making the plastic conductive. This trend of formulating improved composites with materials already in hand will continue in the 1980's.

The Board Industry of the 1980's will likewise make use of emerging technology in order to successfully compete with other construction materials. While solid wood and plywood become more unavailable, the use of wood flake construction takes on an important status. Particle-board and medium density fiberboard will continue their steady market acceptance while structural waferboard and oriented strand-board are two developments that will reach their full potential in the 1980's. Cost/benefit advantages of such composites will be further improved by the appropriate selection of an optimal wood binder. Substitution of liquid resins for powdered resins will occur with resultant improved performance and processing. By the end of the decade the chemicals and resins required to bond wood could very readily be obtained from the tree itself. One sees a future where total tree utilization is realized and the forest refinery competes with the oil refinery.

If the number of new processes being introduced in this field at the same time is any indication of market potential then watch for lignocellulose chemicals to take off in the not too distant future. An informal count of such processes numbers seven including, Battelle/Geneva, University of Pennsylvania/GE licensed to Biological Energy Corp., Gulf/U. of Arkansas licensed to United Bio Fuel, Vulcan Cinci/Stake Technology, NYU/Pfleiderer process, American Can process, Isotech process licensed to the Motor Energy Co.

Marketplace demands will continue to challenge design engineers, chemists, and manufacturers alike. Energy, a safe working environment, and the use of new technology will be three forces that will shape the future of structural materials.

This symposium and future symposia will provide the incentive for the development of improved products and advancement of technology. To share in these exchanges is both a privilege and a benefit.

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