

Young professors exploring pulp and paper research with support of TAPPI Foundation program

Since 1990, the TAPPI/AF&PA Conference on Paper Industry Research Challenges has been a forum for identifying and bringing new top-level researchers into the pulp and paper industry.

Young professors have been a specific target of these conferences, which bring leading academic and industrial researchers together to discuss potential research opportunities. The idea is to get more academicians involved in pulp and paper research who traditionally have not been working in that area. A "seed money" program provides crucial early support, which could help to promote a pattern of pulp and paper research throughout an academic career. The "seed money" funding is made available through the TAPPI Technology Research Funding Program of the TAPPI Foundation.

Changing perceptions

After the conferences, it is typical for those who attend to comment that their perceptions have changed. The academic participants often express the opinion that a relationship exists between industry needs and the traditional fields of research and indicate a willingness to conduct research in these areas, if funding exists.

What impact does the program have on paper industry research today? *Tappi Journal* representatives recently spoke with some researchers who attended a Research Challenges Conference and who subsequently received grants from the TAPPI Foundation program. They came from such fields as chemical and mechanical engineering; their prior knowledge about the pulp and paper industry varied widely. All acknowledged that TAPPI's support played a significant role in their ability to carry out their research. They are:

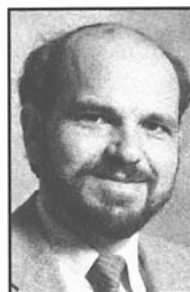
- Leif A. Carlsson, professor, Department of Mechanical Engineering, Florida Atlantic University, Boca Raton, FL. *Topic:* Micro Model of Paper.
- Warren T. Ford, professor, Department of Chemistry, Oklahoma State University, Stillwater, OK. *Topic:* Oxidation of Lignin Model Compounds Catalyzed by Metallophthalocyanines.
- Robert L. Powell, professor, Department of Chemical Engineering, University of California–Davis, Davis, CA. *Topic:*



Carlsson



Ford



Powell



Scamehorn

Studies of the Fluid Mechanics and Rheology of Pulp Suspensions Using Nuclear Magnetic Resonance Imaging.

- John F. Scamehorn, Asahi Glass Chair in Chemical Engineering and Associate Director of the Institute for Applied Surfactant Research, Oklahoma University, Norman, OK. *Topic:* A Fundamental Study of the Flotation Deinking Process.

A mechanical engineer's perspective

Leif A. Carlsson, a native of Sweden, earned his Ph.D. degree in mechanical engineering in 1980. From 1975 until 1980, he was a research engineer in the Paper Technology Department

¹Also currently serving as program director of the Fluid Dynamics and Hydraulics Program, Division of Chemical and Transport Systems, at the National Science Foundation.

Research Challenges

at the Swedish Forest Products Laboratory (STFI). His background gave him "quite a bit" of experience in paper. He attended the research conference in 1990.

Briefly, Carlsson's work is a continuum model of the structure of moderate- to high-density papers. Carlsson said in addition to the Foundation's assistance, he also received some matching funds from a Swedish company for some experiments conducted in that country. "Thanks to the TAPPI grant, it pooled some extra resources overseas," he said.

While it's still too early to measure tangible results, Carlsson said he is hopeful that the research will lead to a more accurate, factual model that can be used to predict the elastic properties of paper. After the work is completed, the goal is to discuss it with members of industry "to get some input for further direction," he said. "Because I'm not so closely connected with the paper industry, it's hard to see where the needs are."

NOTE: Carlsson's paper with coauthor L. Subramanian, entitled "Influence of voids on the engineering constants of paper: Part 1—Continuum modeling and Part 2—Void modeling," will appear in the November and December issues, respectively, of Tappi Journal.

What might happen to lignin?

"I went to that meeting without any knowledge as to what was going on in research in the paper industry," said Warren T. Ford, who holds a Ph.D. degree in organic chemistry. Before the meeting, he had "talked briefly with a couple of people in the industry concerning the possibility that some things that we were doing might have the potential to degrade lignin."

Ford is an organic and polymer chemist whose research is devoted largely to understanding the chemistry of what happens in colloidal dispersions when an attempt is made to oxidize or hydrolyze organic compounds in aqueous dispersions that contain colloidal particles.

Ford said attending the meeting reinforced an idea he had, that some of the catalytic methods for oxidation of lignin or lignin fragments he had been working on would be worth further effort. "Consequently, I wrote a proposal," he said. The meeting also gave him a much better understanding of the major problems in the pulp and paper industry. "I really didn't know what was done in paper processing before I went to the meeting," he said.

Ford said the work is of a very basic nature. "What I would like to be able to do is find out if our oxidative catalytic methods can cleave small model compounds of lignin, break it down into smaller pieces. I think answering that question is all I can realistically expect to accomplish on the current project. In the long run, the question is: How does one break down the lignin itself and not just these small fragments? That problem is more complicated because lignin itself is often in inaccessible environments."

Had he not attended the conference, Ford said he might have continued to ask people within the industry about the availability of funds for a small project. "At the conference, it was clear that the way to do this was through TAPPI," he said.

Surfactant expertise

John F. Scamehorn holds a Ph.D. degree in chemical engineering; his area of research has been in surfactant science and technology. When he was invited to attend the 1990 Research Challenges Conference, he had little knowledge about the pulp and paper industry. "My main exposure had been through people working in films on paper," he said.

"Attending the conference exposed me to the wide use of surfactants and to the industrial processes. I could see where I might be able to contribute some ideas, given my surfactant expertise, to help look at some problems in the industry," he said.

TAPPI is supporting Scamehorn's work in deinking and paper recycle, specifically, trying to understand the fundamental mechanisms of flotation deinking processes. Even though this is being done commercially, there have been very few fundamental studies, so product improvements have been on an empirical basis, he said. "Technologically, I want to work on deinking so-called Type III inks, laser-printed and xerographic inks, in which technology is much less developed," he said.

Ultimately, Scamehorn said, the project should help to explain the interaction between the surfactant and the ink particles, and the calcium and the cosurfactant as well, in the flotation process. How do the components work together to produce an optimum formulation for the deinking process, and what are the best conditions?

Scamehorn said he received a substantial grant from the State of Oklahoma to conduct work in this area after he received the TAPPI grant. "Having the TAPPI grant gave me credibility and was largely responsible" for obtaining other resources to continue the work after the TAPPI grant expires, he said.

Fluid mechanics

Robert L. Powell earned a Ph.D. degree in 1978 from the Department of Mechanics and Materials Science at The Johns Hopkins University, Baltimore, MD. He described his prior knowledge of the industry as "fair to good" (in 1991, he was a research scientist at the Swedish Forest Products Research Laboratory in Stockholm). His research efforts have raised that level of knowledge to "good to very good."

Powell's work supported by the TAPPI Foundation involves the use of nuclear magnetic resonance imaging to study the fluid mechanics and rheology of pulp suspensions. A paper on the use of NMRI to measure mean velocity profiles of wood pulp suspensions undergoing steady pressure-driven flow through a horizontal circular pipe was published in the March 1994 issue (p. 145) of *Tappi Journal*.

Powell said his attendance at the conference in 1992 had "quite a bit" of impact on his decision to pursue research related to the pulp and paper industry. "I already had a strong sense of industry interest and support down the road," he said. His work is directly related to the papermaking processes,

particularly in such areas as headboxes, pumping, separation, and formation. With several phases of the investigation complete, Powell said he "absolutely" plans further investigations into related topics. "As work progresses, we discover more and more things to do."

Foundation information

TAPPI has continued in its active efforts to provide seed funds for new research efforts in universities. The funds for this program are provided by TAPPI Foundation and evaluation of

proposals is accomplished by TAPPI's Research Funding Committee.

With the inclusion of four awards granted in February 1994, the total number of awards since the program began in 1992 has been 20, with more than US\$ 737,000 being given to the investigators. Of the awards given thus far, nine have been granted to academic personnel who attended the annual TAPPI/AF&PA Research Conference.

For more information on the TAPPI Foundation, call (404) 446-1400, ext. 266 or ext. 211. 