Design and Demonstration of Multiport Cylinder Dryers

Multiport Dryer Could Create Paper Drying Breakthroughs

Argonne National Laboratory (ANL) has developed a multiport dryer design that could create breakthroughs in drying pulp and paper. The dryer concept involves the flow of steam through multiport passages that are in close proximity to the cylinder dryer surface. This new design achieves significantly higher drying rates than those of conventional dryers by minimizing condensate formation, which reduces heat flow, and by maximizing the heat transfer surface area. Because many U.S. pulp and paper mills have paper machines that are dryer-limited, even a small increase in drying rates can have a big impact on production. Experimental data suggests drying rates can be improved by 20% (relative to spoiler bar technology) to 90% (in cylinder dryers without spoiler bars). Even a 20% increase will translate into billions of dollars in sales for the pulp and paper industry.

Argonne has already proven the feasibility of the concept in laboratory-scale tests conducted during the first phase of the project. During the second phase follow-on project, Argonne and its project partners will fabricate and test a full-scale prototype with the goal of doubling current drying rates. The prototype will also demonstrate the low cost of a multiport dryer retrofit when compared to that of a new dryer.

Benefits for Our Industry and Our Nation

- Increase drying rates and productivity by 20-90%
- Reduce steam consumption by 3-4%
- Decreased CO₂ emissions
- Inexpensive as a retrofit
- Increased machine speed
- Enhanced global competitiveness of the U.S. pulp and paper industry

Applications in Our Nation’s Industry

High-performance, compact multi-port condensers are already being used in air conditioner condensers in the auto industry and other fields. In this project, Argonne is applying the technology to develop advanced dryers for the pulp and paper industry. Existing cylinder paper dryers may be retrofitted to include the multiport design for 20% of the cost of a new dryer and little downtime.
**Project Description**

**Goal:** Fabricate and demonstrate a dryer that can increase the current drying rate by 20-90% at reduced manufacturing costs in a full-scale performance test.

In the multiport dryer concept, steam flows through “ports,” or longitudinally oriented passages, close to the cylinder dryer surface. This innovative design minimizes the condensate layer (improving heat transfer) and increases the surface area of the dryer shell.

During the first phase of the project, initiated in November 1997, scientists at ANL demonstrated the proof-of-concept for the design. In this second renewal phase, researchers will develop and validate heat transfer and pressure drop correlations for the design of a prototype. The prototype will then be designed and fabricated, and full-scale testing of the dryer for retrofit applications will be conducted.

**Project Partners**

Argonne National Laboratory
Argonne, IL

Eastern Pulp and Paper Corporation
Lincoln, ME

The Johnson Corporation
Three Rivers, MI

University of Illinois at Chicago
Chicago, IL

For additional information, please contact

Drew Ronneberg, Ph.D.
Industrial Technologies Program
Phone: (202) 586-0205
Fax: (202) 586-9234
E-mail: Drew.Ronneberg@ee.doe.gov

Steve Choi, Ph.D.
Argonne National Laboratory
Argonne, IL 60439
Phone: (630) 252-6439
Fax: (630) 252-5568
E-mail: choi@anl.gov

**Progress and Milestones**

- Designed and fabricated a prototype multiport dryer

**Results**

Argonne National Laboratory (ANL) has developed an multiport dryer (MD) design concept that could create breakthroughs in drying pulp and paper concept. Experimental studies were undertaken in ANL’s MD Heat Transfer Test Facility. Phase I has shown that this new MD would provide significant benefits over existing technology, including the fact that retrofitting of existing cylinder dryers with MD technology will improve productivity, capital effectiveness, energy efficiency, competitiveness, and environmental performance.

Full-scale tests leading the technology to commercialization are to be demonstrated next and are currently underway in the second phase of this project.

**A Strong Energy Portfolio for a Strong America**

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

October 2006
Project completed in September 2004
Full award # 000785

For more information, visit www.eere.energy.gov/industry or call 1-877-337-3463