



P2 Bulletin

the newsletter of the New York State Pollution Prevention Institute (NYSP2I)

Special Edition!

A P2 Bulletin Special Edition: Research & Development

The New York State Pollution Prevention Institute's mission is to make New York State more sustainable for the public, the environment, and the economy through reductions in toxic chemical use, the efficient use of raw materials, energy and water and reductions in emissions to the environment and waste generation.



NYSP2I's five core programs designed to achieve this mission are:

- 1) Direct Client Assistance
 - 2) Community Grants
 - 3) Outreach and Education
 - 4) Priority Sectors
 - 5) Research & Development (R&D).
- In this Special Edition, the R&D program is highlighted.

The Focus

NYSP2I's R&D Program focuses on applied research — research that will lead to more immediate solutions to keep New York State companies competitive in the marketplace while reducing their environmental footprint. R&D projects are intended to address specific **environmental challenges presented by NYS companies or sectors**. The technology developed is intended to be transferable and applicable to other companies in New York State. A key component of the NYSP2I program is the ability to perform targeted R&D in realistic manufacturing conditions. Therefore, projects undertaken in collaboration with partnering companies are encouraged.

R&D needs are identified through the NYSP2I Advisory Board, NYS Department of Environmental Conservation, University and Regional Technology Development Center partners, and through NYSP2I's Direct Client Assistance and Priority Sector projects. Analysis and prioritization of high impact/high opportunity industry sectors, technologies, processes and product categories — from a health, environment and economic impact also play a major role in focusing the R&D projects.

R&D projects may also address product and process design, evaluation of alternative materials and process engineering, evaluation of opportunities across supply chains, green chemistry approaches and other areas that would further the mission of the NYSP2I.

Research and development is critical to advancing the competitiveness and sustainability of New York State companies. NYSP2I's R&D Program supports new knowledge and innovative pollution prevention technologies to benefit all of New York State.

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NYSP2I's R&D projects conducted by Clarkson



Evaluation of A Green Courtyard: Stormwater Reduction and Treatment to Mitigate Impact of Atmospheric Discharges of Aluminum Industry

This R&D project was conducted at Clarkson University by Dr. Stefan Grimberg & Dr. Thomas Holsen, of the Civil and Environmental Engineering department. The study focused on Alcoa's Massena West facility. Alcoa's Sustainable Water Strategy goal for the operation of one of its Massena smelters is to achieve

self-sufficiency by 2020. This includes the minimal use of fresh water and 100% recycle of all process water resulting in no discharge into any receiving waters. In order to achieve this long-term goal several innovative and sustainable technologies are being investigated. This project built upon previous work by Alcoa investigating the use of a green courtyard stormwater treatment system for the removal of fluoride and aluminum from stormwater.



Dr. Thomas Holsen

Evaluation of a Green Courtyard

University: Clarkson

Industry Partner: Alcoa – Massena West facility

Company Goal: Minimal use of fresh water and 100% recycle of all process water resulting in no discharge into any receiving waters

Project: Further investigate use of a green courtyard stormwater treatment system to reuse storm water

Results: Provide data on removal of fluoride from storm water to advance process towards full-scale deployment

P2 Benefits: Reduce water use; address fluoride contamination (Hydrogen fluoride releases classified by EPA as a major contaminant affecting human health)

The Green Courtyard system consists of a vegetated area that serves as a filter to remove particulate matter and allow infiltration to occur to reduce run-off. Captured rainwater then passes through a reactive media removing fluoride through adsorption.

The research demonstrated the feasibility of the proposed process to remove fluoride from stormwater consistently. Throughout two field seasons stormwater quality from the green courtyard system was significantly improved meeting consistently discharge regulations. In addition the green courtyard design significantly reduced peak stormwater flow.

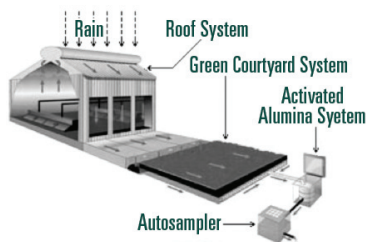
Ultimately enough data has been collected to advance the process towards full-scale deployment. Several Alcoa locations are currently considering the installation of these systems. Data from this study has been used to determine engineering design parameters needed for process scale-up and economic analysis. Through additional funding from Alcoa the project will collect data throughout the 2011 field season to verify the long term performance of the optimized system.



Dr. Stefan Grimberg

"Through the NYSP2I funding significantly more data could be collected, which resulted in the process to be a lot more developed than could have been hoped for with the Alcoa funds alone. In addition the NYSP2I funding allowed for the development of a mathematical model, which is needed for any scale-up process."

The project team presented results at the 83rd Annual Winter Meeting of the New York Water Environment Association on February 7-9, 2011 in New York City and at the 22nd Annual Nonpoint Source Pollution Conference of the New England Interstate Water Pollution Control Commission on May 17-18, 2011, in Saratoga Springs. In addition, an article entitled "Modeling the Performance of a Green Courtyard System to Remove Contaminants from Stormwater" was submitted to the *Journal of Environmental Management* in March 2011.



Green Courtyard System at Alcoa — Massena West facility

ACA Low Temperature Lead-free Electronics Packaging

University: RIT

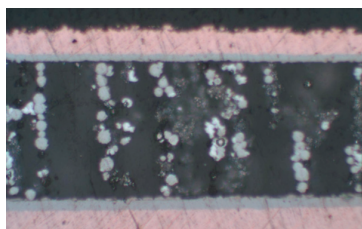
Industry: Electronics Assembly

Industry Goal: Eliminate lead from the printed circuit board assembly process and the use of high temperature lead free solder alloys

Project: Demonstrate the influence of humidity aging and performance of prototype assemblies under high humidity conditions; investigate new adhesive formulations

Results: Provide data comparing existing adhesives to new adhesive formulations developed for enhanced performance

P2 Benefits: Eliminate lead and environmentally hazardous flame retardants (brominated compounds); reduce energy consumption for the curing process



Microscopic analysis of formulation
25(830NS):1(Catalyst):0.25PTA

Novel Anisotropic Conductive Adhesive for Low Temperature Lead free Electronics Packaging

This R&D project was conducted at Rochester Institute of Technology (RIT) by Dr. S. Manian Ramkumar along with Dr. K. S. V. Santhanam and Dr. Changfeng Ge at RIT's Center for Electronics Manufacturing and Assembly. The purpose of the project was to investigate humidity and its affects using the novel Anisotropic Conductive Adhesive (ACA) material and develop an improved adhesive formulation.

A novel structured array Anisotropic Conductive Adhesive (ACA) material was introduced in the market, as a possible lead-free solder alternative for electronics assembly applications. The use of this ACA material would eliminate lead from the printed circuit board (PCB) assembly process and also the use of high temperature lead-free solder alloys, providing additional environmental benefits because the assembly would not require a high temperature curing process. However, this material is not being widely used because of performance concerns.

The project team investigated ACA material property enhancements by using special additives to improve humidity aging behavior and enhance long term performance. The team compared the performance of the existing adhesive formulation to a new formulation that they developed. The performance of the new formulation appeared to be superior.

Significant progress towards understanding of the formulation was made through this research. The moisture uptake has been considerably reduced in the new formulations. The team will continue its research with the next step being to understand internal magnetic field effects.



Dr. S. Manian Ramkumar

"The grant funding from NYSP2I was instrumental in providing the research impetus to investigate the moisture behavior of the novel ACA and investigate new chemistries to mitigate the influence of moisture. This has increased the confidence in adopting the novel material as a possible replacement for tin-lead and lead-free solder."

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NYSP2I is expanding its R&D Program to include a student competition!

NYSP2I's student R&D competition is intended to provide seed funding for student teams developing innovative environmental products or processes. Students from the four Partner Universities will compete for the awards and the project results will be exhibited at a Partner University campus. The program is currently in development with an expected inaugural launch in Fall 2011.

The Research

NYSP2I capitalizes on the strengths of its Partner Universities: Rochester Institute of Technology (RIT), Clarkson University, Rensselaer Polytechnic Institute (RPI), and University at Buffalo (UB). As a result of this partnership, NYSP2I is capable of conducting a wide array of research and development. A total of 19 unique testbeds, or demonstration facilities, are available to the NYSP2I and used in technology development experiments for projects that support the goals of pollution prevention. These testbeds not only allow for rigorous, transparent and replicable testing and validation of technologies, scientific theories, and analytical tools, but may also be used to publicly demonstrate technologies and tools to New York State industries, university researchers, government agencies, non-profit organizations and citizens.

NYSP2I encourages both short and long term research projects. Shorter-term projects which address environmental challenges at individual companies are typically identified through NYSP2I's Direct Client Assistance Program and managed by the NYSP2I Director. These projects are conducted by the Partner University offering the area of expertise required by the technological need. For longer-term strategic R&D projects, a Request for Proposals (RFP) is disseminated annually to faculty at all four Partner Universities. The RFP is developed by NYSP2I's Technical Advisory Committee (TAC) and solicits pollution prevention proposals focused in support of NYSP2I's mission and the target areas of need.

NYSP2I Testbeds	Location
Surface Cleaning Technology Evaluation Facility	RIT
Printing Applications Laboratory	RIT
Electronics Manufacturing and Assembly	RIT
Life Cycle Environmental Engineering of Nanomaterials	RIT
Bio-Fuel Energy System TestBed	RIT
Water Recovery and Reuse	Clarkson
Advanced Materials Synthesis for Pollution Reduction	Clarkson
Monitoring/Sensors	Clarkson
Environmental Systems	Clarkson
Green Supply Chain Management	Clarkson
Energy from Waste Biomass Resources Testing Facility	Clarkson
Computational Center for Nanotechnology Innovations (CCNI)	RPI
Polymer Processing and Testing	RPI
Membrane Process Test Facilities	RPI
Particle Mixing TestBed	RPI
Efficient Lighting TestBed	RPI
Aqueous Process Management	UB
Sustainable Chemical Processes	UB
Toxicology and Risk Reduction	UB

Evaluation Process

The Technical Advisory Committee (TAC) oversees the R&D Program. The TAC consists of a representative from each Partner University, as well as a liaison from NYSP2I and the NYSDEC. When reviewing proposals, the TAC looks at several fundamental criteria such as the benefit to NYS, cost versus value, project plan and timeline, and research approach. Once proposals are selected, the TAC oversees the progress, results, and reporting of the R&D projects.

Projects to Date

NYSP2I has received 13 proposals from the Partner Universities. NYSP2I funded two projects thus far, awarding \$150,658. This summer, NYSP2I will be awarding up to \$150,000 for additional projects.



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