ORNL receives three 2021 FLC Awards for technology transfer

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The Reactive Additive Manufacturing Machine was recognized with a 2021 FLC Award. The large thermoset 3D printer was co-developed by ORNL and Magnum Venus Products. Credit: ORNL, U.S. Dept. of Energy

Three technologies developed by researchers at the Department of Energy's Oak Ridge National Laboratory have won National Technology Transfer Awards from the Federal Laboratory Consortium. The annual FLC Awards recognize significant accomplishments in transferring federal laboratory technologies to the marketplace.

ORNL is among 12 DOE national labs to be honored out of 33 winners from FLC's network of more than 300 federal laboratories, facilities, and research centers. Since the consortium's founding in 1986, ORNL has won a total of 68 awards.

"One of our most important contributions as a national laboratory comes when our researchers' breakthroughs are put to work in the private sector," ORNL Director Thomas

Zacharia said. “It is an honor for our collaborative teams to be recognized for translating scientific discovery to societal benefit.”

The lab was recognized in two categories:

Excellence in Technology Transfer

Impactful Technology Transfer of Revolutionary Large-Scale, Energy-Efficient 3D-Printer, co-developed by ORNL and Magnum Venus Products.

ORNL and MVP collaborated on the development of a one-of-a-kind Reactive Additive Manufacturing, or RAM, system capable of producing large, lightweight parts. RAM utilizes thermoset materials rather than the thermoplastics typically used with polymer 3D printers and incorporates an innovative design that offers high-volume parts production.

RAM enables the production of high-quality products at a faster rate, utilizes less material and consumes a fraction of the energy compared to other 3D printers. MVP has signed two licenses with ORNL and offers the large-scale, energy-efficient RAM 3D printer as a product to manufacturers. The printer is anticipated to be used in a wide range of applications for the defense, marine and aerospace industries.

ORNL’s research team included Vlastimil Kunc Christopher Hershey and John Lindahl. Eugene Cochran of ORNL and Mike Kastura of MVP led the commercialization.

This project was supported by the DOE Office of Energy Efficiency and Renewable Energy, Advanced Manufacturing Office and used resources at the Manufacturing Demonstration Facility, a DOE-EERE user facility at ORNL. Additional support was provided by MVP through a Cooperative Research and Development Agreement.

The ORNL research team that developed and licensed a suite of battery technologies to energy storage startup SPARKZ is shown during the official licensing ceremony with ORNL Director Thomas Zacharia in February 2020. Credit: ORNL, U.S. Dept. of Energy

Building Sustainability with Cobalt-Free Battery Technologies, developed by ORNL and licensed to SPARKZ.

ORNL researchers developed a suite of technologies designed to eliminate the rare and costly cobalt metal found in the cathodes of lithium-ion batteries that are used to power portable electronic devices and electric vehicles. ORNL's technologies provide cobalt-free alternatives without sacrificing battery performance.

The technologies licensed by energy storage startup SPARKZ include high-energy density secondary lithium batteries; cobalt-free layered oxide cathodes; nonaqueous electrolyte formulation for faster charging; early transition metals for use in cathodes; and battery materials scaled up utilizing novel chemical processes. Each technology is designed to overcome existing limitations on energy density and help electric vehicles charge more efficiently. Achieving this goal could also aid energy storage in grid applications.

ORNL's Ilias Belharouak and Jagjit Nanda led the research development. Mike Paulus and Jen Caldwell of ORNL, and Sanjiv Malhotra, CEO of SPARKZ, collaborated on the commercialization.

DOE's Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Office selected the ORNL-SPARKZ partnership for the DOE Lab Investment Incubator Activity, which focuses on maturing lab-scale technologies for commercialization. DOE-EERE's

Vehicle Technologies Office supported the initial research that enabled this technology development.

Merlin Theodore, with the N95 filter material at the Carbon Fiber Technology Facility, collaborated with the team that developed the process for converting melt-spinning capabilities into the production of polypropylene. Credit: ORNL, U.S. Dept. of Energy

Impact

Securing Domestic Production of N95 Masks During Coronavirus Pandemic, developed by ORNL and commercialized by Cummins and DemeTECH.

ORNL researchers adapted melt-blowing capabilities at DOE's Carbon Fiber Technology Facility to enable the production of filter material for N95 masks in the fight against COVID-19. Polypropylene was used and supplemented with an additive from Techmer PM, a polymer material manufacturer. N95 mask material inventor Dr. Peter Tsai assisted ORNL in building a novel electrostatic charging device to charge the melt-blown material in production. ORNL produced greater than 95% filtration-efficiency material equivalent to 9,000 masks per hour.

The technology was transferred through a user agreement to Cummins, an air, fuel and lube filtration product supplier, for scale-up and manufacturing. ORNL worked with Cummins to adapt the production line, create the necessary material, install electrostatic charging devices and test the efficiency. Cummins produced enough material to supply more than a million masks per day. DemeTECH, a medical supply company, also used ORNL's technology to manufacture filtration material and masks. They planned to expand

their Miami-based operations to include 15 production lines capable of yielding three million surgical masks and half a million N95 masks per day.

ORNL's Merlin Theodore led the filter media research and collaborated with ORNL's COVID manufacturing research lead Lonnie Love along with Scott Smith and Craig Blue, and Peter Tsai, formerly of the University of Tennessee. Susan Ochs of ORNL and Christopher Holm from Cummins and Luis Arguello, Jr. from DemeTECH led the commercialization. Alan Franc provided Techmer PM material support.

Funding for this project was conducted in coordination with the U.S. Department of Health and Human Services and funded in part by the DOE Office of Science through the National Virtual Biotechnology Laboratory (NVBL), a consortium of DOE national laboratories focused on response to COVID-19, with funding provided by the Coronavirus CARES Act. DOE's Carbon Fiber Technology Facility COVID-19 efforts at ORNL were also supported by the Office Energy Efficiency and Renewable Energy's Advanced Manufacturing Office.