

## American Process Inc. Announces Partnership with Oak Ridge National Laboratory to Make 3D Printing Plastic Resins Stronger and More Sustainable

*Materials scientists from the renewable, biomaterials industry and government aim to advance industrial adaptation of 3D printing by improving the mechanical strength of printing resins with low cost, ultra-strong nanoparticles extracted from trees. “Nanocellulose” promises to be an economical substitute for expensive carbon fibers currently used in 3D printing to make load bearing parts.*

American Process Inc. (Atlanta, GA) and Oak Ridge National Laboratory (Oak Ridge, TN) recently signed a joint agreement to improve the strength of 3D printing plastic resins using nanocellulose, a rapidly emerging high performance, bioderived nanomaterial. A well-known constraint of 3D printing is the limited number of feedstock materials available. Traditionally used thermoplastic resins provide inadequate mechanical strength to printed parts for load bearing applications.

The goal of this project is to render 3D printing technology suitable for producing load-bearing parts for a wide range of industries including automotive and mold manufacturing that have strengths similar to metallic components such as aluminum and cost-parity with traditional materials.

While carbon fibers have been used as a reinforcing material for 3D printing resins, their high cost and dependency on petroleum has led researchers at ORNL to investigate more economical alternative reinforcing agents such as nanocellulose.

According to American Process Inc.’s CEO, Theodora Retsina, “Nanocellulose can enhance the performance of plastics in an environmentally friendly and market competitive way. Carbon fibers are extremely strong and lightweight but expensive to produce and used only in the highest end applications such as aerospace and luxury vehicles. Nanocellulose is as strong as carbon fiber and are lower weight. With our manufacturing breakthrough, nanocellulose is significantly more cost competitive than carbon fibers. We didn’t invent nanocellulose; we made it less expensive, thermally stable at high temperatures, and gave it functionality to blend with hydrophobic polymers – thereby enabling market applications and opening the road to commercial production.”

American Process began production of a suite of BioPlus™ nanocellulose products in April 2015 at their pre-commercial BioPlus™ plant in Thomaston, Georgia. Material from this plant will be used by ORNL to 3D print a large scale component on their giant “Big Area Additive Manufacturing” (BAAM) 3D printing machine, which is 500 to 1000 times faster than most. ORNL developed the first prototype BAAM machine in partnership with Cincinnati Incorporated (Harrison, OH) using its commercial laser cutting gantry-style platform. ORNL recently used BAAM to print a full-size sports car, which garnered wide-spread media attention. Not resting on their laurels, ORNL then installed the largest 3D BAAM printer in the world, capable of printing components up to 20 feet long, 8 feet wide and 6 feet tall.

Such advances in 3-D printing speed and size are leading to what Richard D’Aveni of the Harvard Business Review calls “The 3D Printing Revolution”. According to D’Aveni, numerous companies are using 3-D printing for production including GE (jet engines, medical devices, and home appliance parts), Lockheed

Martin and Boeing (aerospace and defense), Aurora Flight Sciences (unmanned aerial vehicles), Invisalign (dental devices), and Google (consumer electronics).

In the aerospace and automotive industries, 3D printing can help achieve performance gains such as light weighting and fuel efficiency if high strength resin composites are more readily available that provide greater tensile strength, durability, and resistance to impact. According to the U.S. Department of Energy (DOE), the limiting factor in use of lightweight materials in vehicles has been availability of sufficient quantities at affordable cost.

"We are excited about the opportunity to work with American Process Inc. to develop nanocellulose reinforced polymers with the objective of achieving a completely bio-derived new structural material for additive manufacturing," said Craig Blue, Director, Advanced Manufacturing Program and Manufacturing Demonstration Facility at ORNL.

The research at ORNL is supported by the Advanced Manufacturing Office in DOE's Office Energy Efficiency and Renewable Energy.

#### About the Collaborators

American Process Inc. focuses on pioneering renewable materials, fuels and chemicals from biomass and develops proprietary technologies and strategic alliances in the field to be scaled industrially throughout the world.

ORNL is managed by UT-Battelle for the Department of Energy's Office of Science. DOE's Office of Science is the single largest supporter of basic research in the physical sciences in the United States, and is working to address some of the most pressing challenges of our time. For more information, please visit <http://science.energy.gov>.



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