2020 AWARDS FOR COMPOSITES EXCELLENCE FINALISTS

Sponsored By: Composites One

DESIGN: Most Creative Application

UTK Filament Tower

University of Tennessee

The UTK filament tower was the first composite structure featured at Exhibit Columbus, a biennial event where designers create outdoor installations and experiences. A team of 23 students, faculty, and staff used a nine-axis robot and a novel coreless filament winding technique, which eliminated the need for a surface mold, to construct the 30-foot lattice tower. It featured 3D-printed composite bases and 27 composite components, each weighing between 5-30 lbs. and measuring 3-8 feet in length. The project explored computational design and robotic fabrication of composite structures for architectural applications, highlighting the unique aesthetic qualities of carbon and glass fiber.

Resin Supplier: Hexion

Fiber Reinforcement Supplier: Teijin and SGL

MANUFACTURING: Equipment and Tooling Innovation

3D Printing Continuous Carbon Fiber/Thermoset Composites

University of Delaware

The University of Delaware Composite & Additive Manufacturing (CAM) Laboratory has developed a localized in-plane thermal assisted (LITA) 3D printing technique to fabricate continuous fiber reinforced thermoset composite parts. The 3D printing technique is based on a robotic system consisting of printing head, liquid thermoset resin dispenser, and heater. This 3D printing technique allows thermoset polymer liquid with a controllable viscosity and degree of curing to enable its fast and near-simultaneous infusion and curing to implement in situ solidification of composites into arbitrary shapes. Wide range of thermoset polymers and fibers (e.g., carbon, glass, and Kevlar) could be applied.

Resin Supplier: System 4600 High Temp Infusion Epoxy Resin; FibreGlast

Fiber Reinforcement Supplier: Toray T300 3K

CrossTrack Composite Manufacturing Software Suite

JETCAM International s.a.r.l.

CrossTrack CMS not only provides automated CAD import and nesting capabilities for prepreg composites cut on CNC knife cutters, but it also provide location and life tracking for both raw materials and ply kits. Consumption can be tracked by length (rolls), quantity (sheets), weight (fasteners, etc.) and volume (liquids/powders). The latest release includes tracking of layup tools, allowing a kit to be associated with a tool as they both move around the facility. Custom fields allow capabilities such as tracking the number of standard/deep cleaning cycles a tool has been through, as well as tracking overall life.

Lightweight, Lower-cost COPVs for Hydrogen FCEVs, Providing Extended Vehicle Range

3M

A lightweight, cost-effective composite overwrapped pressure vessel (COPV) for hydrogen storage in fuel cell electric vehicles (FCEVs) is introduced. The carbon fiber vessel is enabled through use of advanced resin technology and unique composite design. 3M Matrix Resin 8833, a nanocalcite-modified epoxy with high tensile modulus, imparts an increase in fiber delivered strength (FDS) to the composites. This increase in FDS enables the redesign of these thick-walled structures,reducing weight, eliminating expensive fibers and lowering manufacturing costs. In FCEV applications where the outer dimensions of the tank are fixed, a redesign can use an expanded liner volume thus increasing vehicle range.

Resin Supplier: 3M

Fiber Reinforcement Supplier: Toray

Integration of Additive Manufacturing and Compression Molding for High-Performance Composites

Oak Ridge National Laboratory

In this work, large-scale additively manufactured (AM) preforms using multi-materials are compression molded (CM) to produce a high-performance short carbon fiber reinforced thermoplastic composite (S-CFRTP). AM and CM techniques are integrated to achieve control over the fiber alignment (microstructure) and reduction in void content for the improved mechanical performance of the composite. The new integrated manufacturing techniques is termed as additive molding-compression molding (AM-CM) technique. CF/ABS samples prepared by AM-CM technique, showed significant improvement of 11.15 %, 35.27 %, 28.6% and 74.3% in the tensile strength, tensile modulus, flexural strength, and flexural modulus respectively when compared to ECM processed samples.

Resin Supplier: Techmer PM

Fiber Reinforcement Supplier: Techmer PM

UV Cured Thermoset Composite for Building Construction

Mighty Buildings

Large-area additive manufacturing of building components/modules up to 3700 cubic feet/450 sf footprint, with almost infinite possibilities of shape, size, & geometry. Material is a UV cured thermoset composite that, when combined with foam insulation in the infill cavities, can serve as the entirety of a wall from interior finish to exterior finish and everything in between (fire/air/water/thermal/vapor barrier, structural, etc.). The material cures quickly enough to produce unsupported spans while maintaining full cohesion between layers. This allows printing of the roof as well as floor/walls and unlocks free form/organic design at an affordable price.

Resin Supplier: Sartomer Arkema

Filler & Additives Supplier: Rio Tinto

Fast Press Cure, A Disruptive High Volume Composite Manufacturing Method

TRB Lightweight Structures Ltd

TRB has developed a fully automated and vertically integrated process to unlock composites at scale, resulting in the manufacture of complex components in a fraction of the time of traditional hand layup. It works with carbon fiber, glass, hemp and other composite fiber materials and can incorporate EMI shielding, thermal insulation, high voltage insulation in the layup process, to enable the right material mix and structure for a wide variety of components. This innovation means that for the first time, composites can meet the cost, velocity, and quality requirements of the electric vehicle industry.

Resin Supplier: TRB Lightweight Structures

Fiber Reinforcement Supplier: TRB Lightweight Structures

MARKET GROWTH: Composites Sustainability

Changing Asbestos Seeking Public Health with GRP

Soling SAS

Our product was a series of covers to cover the largest drinking water tank in Colombia (53,342 sq ft). The form of installation is made by overlapping the covers with each other. The main market for this product is drinking water storage tanks. The raw material used was GRP as a substitute for asbestos. The biggest challenge was to inject by the RTM Light method a self-supporting roof with a surface area of 207 sq ft per roof, for which it was necessary to use finite element design tools to simulate the part and the mold for the injection process.

Resin Supplier: Andercol

Fiber Reinforcement Supplier: Jushi

Composite Manhole Covers Solve Iron Problems

LyondellBasell

With rising construction activities worldwide, the manhole cover market is expanding. Through the collaboration between LyondellBasell and Composite Access Products (CAP), composite solutions are replacing traditional materials like metal and concrete used in manhole applications due to its superior properties like strength, corrosion resis-

tance, and molding capabilities. Through CAP's compression molding process of LyondellBasell's thermoset material, cost improvements and rapid production cycles are realized when compared to Resin Transfer Molding (RTM) and other fiberglass (FRP/GRP) casting processes. This process enhances quality by reducing entrapped gas, ensuring a complete thermoset polymer cure, delivering fully impregnated fiberglass, and eliminating many post-process operations.

Resin Supplier: LyondellBasell

High-density DUC Board Made of 90% Recycled FRP and Foam Scrap

BUK Industries

This high-density sheet made from 90% recycled FRP and foam scrap has excellent screw retention and physical properties, similar to phenolic sheet. This product uses FRP scrap generated by 99% of the composites industry and converts into viable product, allowing it to compete with any high-density board. This product reduces both disposal cost and landfill addition.

MARKET GROWTH: Infinite Possibility for Market Growth

Composite Architecture: Building and Design with Carbon Fiber and FRPs

Portland State University

COMPOSITE ARCHITECTURE is the first ever book about composite materials used in architecture. Materials such as carbon fiber and other FRPs can lead to buildings that are lighter, stronger, more durable, and better thermally performing. Their properties also allow for new formal possibilities and structural expressions. This book describes the technology underpinning composite materials, their history, sustainability issues, and unique opportunities and challenges in building and construction. Featuring detailed studies of projects by architects including: Snøhetta, Herzog & de Meuron, Zaha Hadid, Kengo Kuma, Diller Scofidio + Renfro, Morphosis, SHoP, Foster + Partners, and including the new Apple buildings.

Heavy Lift Aerial Platform (HLAP)

IYRS School of Technology

Heavy Lift Aerial Platform (HLAP) concept model has a range of applications from urban air mobility, commercial or military, including delivery of goods, observation, inspections, communications, search & rescue, or cinematography. This multi-purpose unmanned aerial vehicle features a 29-pound primary airframe with an all-up flying weight of 61-pounds. The eight power units produce a load capacity of 103-pounds. The array of processes employed include: Direct tool CNC machining, prepreg fabrication, vacuum infusion, 3D printing and hollow form braiding. The 3-year project has involved multiple generations of IYRS students engaged in CAD modeling, CNC operations, and fabrication of various platform components.

Resin Supplier: Thermoset Components - Multiple epoxy prepreg and vinyl ester resin suppliers Thermoplastic components - 3D printing products - ABS