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SPE® ACCE ANNOUNCED BEST PAPERS AND HONORED AUTHORS AT 2023 EVENT:

- **BEST PAPER AWARD WINNER:**

"ENHANCING RECYCLED THERMOPLASTIC COMPOSITE PARTS USING RECYCLED COMPOSITE LAMINATE CUTOUTS" By Garam Kim, Assistant Professor, Purdue University

- **HONORABLE MENTIONS:**

"PRESS FORMING OF E-GLASS FABRIC REINFORCED POLYPROPYLENE: A NUMERICAL STUDY" By Chandra Kishore Reddy Emani, Postdoctoral Researcher, University of Michigan – Dearborn

"INFLUENCE OF WATERJET CUT QUALITY FOR FABRICATION OF TEST SPECIMEN ON MECHANICAL TESTING RESULTS" By Jacob Montrose, Graduate Researcher, Purdue University

TROY (DETROIT), MICH. - The executive planning committee for the SPE® Automotive Composites Conference & Expo (ACCE) announced the best papers and honored authors at their ACCE event on Sept. 6 – 8, 2023 at the Suburban Collection Showplace in Novi, Michigan (Detroit suburb). Garam Kim, Assistant Professor at Purdue University, won the Best Paper Award for his paper "Enhancing Recycled Thermoplastic Composite Parts Using Recycled Composite Laminate Cutouts." Honorable Mention recognitions were awarded to Chandra Kishore Reddy Emani, Postdoctoral Researcher at University of Michigan – Dearborn for his paper titled, "Press Forming of E-Glass Fabric Reinforced Polypropylene: A Numerical Study" and Jacob Montrose, Graduate Researcher at Purdue University for his paper titled, "Influence of Waterjet Cut Quality for Fabrication of Test Specimen on Mechanical Testing Results." The authors were presented with certificates at the conference and their papers were highlighted in the ACCE program schedule and will be published in SPE Automotive and Composites Division newsletters and other industry publications.

WINNER:
Enhancing Recycled Thermoplastic Composite Parts Using Recycled Composite Laminate Cutouts

Garam Kim, Assistant Professor, Purdue University

ABSTRACT:
Composite recycling has gained significant attention due to the increasing global sustainability problems. The mechanical recycling process of fiber-reinforced composite parts involves shredding long continuous fibers within the composite into shorter discontinuous fibers. Since the performance of the resulting short fibers is not as high as that of the original long fibers, the application of mechanically recycled composites is limited. The objective of this study is to enhance the structural performance of recycled composite parts by integrating of a set of continuous fiber composite precuts during the molding process. The 2-dimentional precuts were positioned in the structurally critical regions of the recycled composite part, and the remaining area was then filled with shredded composite material. An aircraft overhead bin door pin bracket was used as the part geometry. The mechanically recycled material and the precuts were made from 60% by weight carbon fiber reinforced PEKK composite. Three different combinations of precuts were designed to create the pin bracket, and their performance was assessed by mechanical testing of the pin bracket. Additionally, digital image correlation (DIC) technology was used to analyze local strain changes and investigate the failure mechanisms of the parts throughout the testing process. The test results demonstrated that the inclusion of properly designed precuts significantly improved the performance of the recycled composite part.

BIO:
Dr. Garam Kim is an Assistant Professor in the School of Aviation and Transportation Technology at Purdue University. He is an affiliated faculty member in the Composites Manufacturing and Simulation Center (CMSC) and manages the Reisbeck Advanced Composite Laboratory (RACL) Dr. Kim has over 10 years of experience in fiber-reinforced composite structures manufacturing, testing, and characterization.

HONORABLE MENTION:
Press Forming of E-glass Fabric Reinforced Polypropylene: A Numerical Study

Chandra Kishore Reddy Emani, Postdoctoral Researcher, University of Michigan – Dearborn

ABSTRACT:
This study focuses on numerically analyzing the deformation behavior of E-glass fabric reinforced polypropylene (PP) prepreg during press forming. A finite element modeling technique is employed in which membrane and shell elements are superimposed to accurately simulate both in-plane and out-of-plane deformations of woven fabrics under shear loading, while also considering the deformation characteristics of the matrix material. The model can predict the maximum draw depths achieved just before failure for the fabric-reinforced PP. The proposed approach represents the prepreg sheet as a superimposed layer consisting of PP and fabric. Under-integrated membrane elements are used to capture the in-plane shear deformation of the fabric, while fully integrated shell elements are used to account for the out-of-plane bending behavior of the fabric and the deformation of the matrix material during press forming. Press forming simulations were conducted with various initial blank temperatures. The draw depths achieved by the prepreg before failure were compared to those achieved with a single layer of unfilled PP using the identical die-punch setup. Failure in the prepreg occurred in the PP layer, where the plastic strains surpassed the failure strain of polypropylene. The highest shear deformation was observed along the diagonal at the die entry radius, coinciding with the location of failure in the PP layer. Additionally, the fabric layer displayed a tendency to buckle.

BIO:
Chandra Kishore Reddy is a Postdoc Research Fellow at University of Michigan - Dearborn. He has completed his Ph.D. in Mechanical Engineering with main focus areas including the study of the deformation characteristics for forming of dry woven fabrics, fabric reinforced PP, forming behavior of thermoplastic polymers and press forming of metals. Some of the work includes the development of forming limit diagrams for dry woven fabrics, study of the influence of shear-tension coupling on woven fabrics and warm deep drawing of Polypropylene

HONORABLE MENTION:
Influence of Waterjet Cut Quality for Fabrication of Test Specimen on Mechanical Testing Results

Jacob Montrose, Graduate Researcher, Purdue University

ABSTRACT:
Abrasive waterjet is an effective method of cutting fiber reinforced composites as it allows for precise cuts without introducing any thermal effects or direct contact with the cutting tool. In composite research, the fabrication of accurate and undamaged test specimens is crucial for testing their mechanical and physical properties. The cutting edge of the test specimen can be varied based on the speed of the waterjet cutting. The quality of the cut edges can have a significant impact on the test result since stress concentrations can be introduced differently under loading depending on the roughness of the edge. In this study, fiber reinforced composite tensile test specimens were fabricated using an abrasive waterjet with different cut qualities. The cut edge quality will be assessed using visual inspection, microscopic image, a surface roughness tester, and a scanning electron microscope. A tensile test was conducted with the test specimens cut with different cut qualities. Digital Image Correlation (DIC) technology will be used to track the local strain change during the test to investigate any stress concentration different at the edge when different cut quality was used. The tensile test data will be analyzed and presented to address importance of using proper abrasive waterjet cutting parameters for fabricating composite test specimen.

BIO:
Jacob Montrose is a Graduate Researcher from Purdue University in West Lafayette, Indiana. Jacob has received his Bachelor of Science degree in Aeronautical Engineering Technology in the School of Aviation Transportation and Technology. While obtaining his undergraduate degree, he worked alongside Dr. Garam Kim as a Research/Teaching Assistant for Advanced Composite Technology. As a graduate student, Jacob will be conducting research on various composite projects. In addition, he is working alongside Dr. Kim and a team of engineers on a 20-month research contract with the FAA

Held annually in suburban Detroit, the ACCE currently draws approximately 500 speakers, exhibitors, sponsors and attendees and provides an environment dedicated solely to discussion, education and networking about advances in transportation composites. Its global appeal is evident in the diversity of exhibitors, speakers, and attendees who come to the conference from Europe, the Middle East, Africa, Asia/Pacific and South America as well as North America. About 20% of attendees work for automotive and light truck, agriculture, truck & bus or aviation OEMs and another 25% represent tier suppliers. Attendees also work for composite materials processing equipment, additives, or reinforcement suppliers; trade associations, consultancies, university and government labs; media; and investment banks. ACCE has been jointly produced by the SPE Automotive and Composites Divisions since 2001.

For more info go to: **https://speautomotive.com/acce-conference/.**

The mission of SPE is to promote scientific and engineering knowledge relating to plastics worldwide and to educate industry, academia, and the public about these advances. SPE's Automotive Division is active in educating, promoting, recognizing, and communicating technical accomplishments in all phases of plastics and plastic-based composite developments in the global transportation industry. SPE's Composites Division does the same with a focus on plastic-based composites in multiple industries. Topic areas include applications, materials, processing, equipment, tooling, design, and development.

For more info go to: **https://speautomotive.com/** and **https://composites.4spe.org/.** For more information on the *Society of Plastics Engineers*, see **https://composites.4spe.org/.**