SPE COMPOSITES

WINTER 2025

Composites Connection™

Official Newsletter of the SPE Composites Division

Reaching Over 1,000 Composites Professionals
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Chairman's Message:

Oleksandr G. Kravchenko, Ph.D.

Dear Composites Division Members,

As 2024 comes to a close, I extend warm holiday wishes and my best for a prosperous new year. This season provides a moment to reflect on our goals and embrace the exciting opportunities that lie ahead for our division and community.

I am thrilled to announce two exceptional additions to the Composites Division Board of Directors.

First, Amanda Nummy brings a decade of expertise in the automotive industry, with a focus on sustainable design and nature-inspired innovation. Her leadership and achievements, including being named one of Plastics News Rising Stars and a Georgia Tech 40 Under 40 honoree, make her an invaluable member to join the Board.

Second, Dr. Srikanth Pilla joins us as a Professor and Director of the Center for Composite Materials at the University of Delaware. Dr. Pilla is a leading researcher in sustainable and lightweight functional materials and his accolades include the EPA's Green Chemistry Challenge award and the DOE's Vehicle Technologies Office Team award.

Amanda's and Srikanth's joining of the Board, underscore CD's commitment to advancing sustainable and innovative practices in composites, while mentoring the next generation of leaders in composites. Please join me in welcoming Amanda and Srikanth to the Board!

Looking ahead, I encourage you to mark your calendars for ANTEC® 2025 in Philadelphia, PA, through March 3-6. This annual event will showcase cutting-edge advancements from across the plastics value chain. Of particular interest to our division, over two dozen presentations will highlight the latest research and innovations in composites, with contributions from industry leaders, academics, and international experts. ANTEC remains a premier opportunity to engage with peers, exchange ideas, and stay at the forefront of our field.

Thank you for your continued dedication to the Composites Division. Wishing you a joyful holiday season and a great start to 2025!

Best regards,
Alex Kravchenko, PhD
Chair, SPE Composites Division

In Memory of Andrew (Andy) Rich

By: Ray Boeman

Andrew (Andy) Lloyd Rich, born in Washington, D.C., lived a life deeply connected to cars, especially British motorsports. His passion seemed predestined—a family joke credits it to an in-womb encounter when his aunt and uncle visited in an MG. By eight months old, a ride-on car motivated his first steps, and by one year, he was intrigued by mechanical systems, learning from his uncle's explanations of toy car mechanics. After moving to Avon, Connecticut, at age five, Andy worked a paper route starting at age 11, saving enough to buy an MG by age 16.

Andy also developed a strong interest in materials, particularly plastics and composites, thanks to conversations with his chemist father, Richard. Though his father wasn't a "car guy," fraternity brother Mel Friedman was, owning Berkeleys. As Andy grew older, he visited Mel's garage to work on cars. When Mel passed away young, Andy inherited his cars, including one he used in his university studies.

Described in Sports Car International's October 1990 issue as a wanderer with a purpose, Andy pursued automotive mechanics training after high school, building skills essential to his career. He earned a business degree in entrepreneurship and new ventures from Northeastern University after

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This Issue:

In Memory of Andy Rich continued...

attending Boston University. His motorsports passion led him to the UK, where he worked for Ford Motor Company. Back in the U.S., he joined MG Restoration Shop Automation before founding Composite Autobody, specializing in restoring fiberglass-bodied British sports cars like Elvas, TVRs, and Lotuses. A licensed racer, Andy competed in motorsports throughout his life.

I first got to know Andy in the early 2000s while he was at DaimlerChrysler and I was with Oak Ridge National Laboratory. We worked on the Automotive Composites Consortium's Focal Project III (FP3), developing a composite-intensive body-in-white. Alongside Nancy Johnson of GM, we traveled to the UK to secure services from Engenuity, which Andy recommended after learning of its crashworthiness work for Mercedes. Though our professional paths diverged when I moved to DOE headquarters, his technical expertise and industry insight remained memorable.

Andy later held roles at Plasan Composites, A. Schulman, and his consultancy, Element6. He was a dedicated board member of SPE's Automotive and Composites Divisions. His love for cars endured; in 2022, he earned a blue ribbon at EyesOn Design in Michigan for his Elva Courier.

Andy passed away on August 6, 2024, just days before his 61st birthday. He is survived by his mother Karen, and two children, Ellora and Nikhil.

His legacy of enthusiasm, craftsmanship, and friendship will be fondly remembered.

This Issue:

Award Report

By: Pritesh Yeole, Ph.D.

Part of the mandate of the Society of Plastics Engineers – Composites Division is to recognize excellence in composite materials development and proliferation. Several awards have been organized for this purpose to honor and recognize such individuals, both on academic and industrial levels. Every year the Composites Division issues these awards that are based on rigorous competitions through solicitation of nominees and applicants. The awards are a) Harold Giles Award, and b) Jackie Rehkpof Scholarship. Other non-financial awards that are open to nominations as of January 1st are a) Honored Service Member / SPE Fellow and b) Composites Division Person of the Year Award. These two awards aim to recognize distinguished contributions from dedicated members of the society.

Harold Giles Scholarships

This award was created in honor of the late Harold Giles who was taken from this world too soon. Harold was one of the best Composite Division Awards Chairs that many of us worked with during his days at Azdel and at UNC. He would have been thrilled to know that we are honoring his name in awarding worthy students. This award is run through SPE International in their Foundation Program series. The Composites Division will select the winners from the pool of applicants in two categories, Graduate and Undergraduate students. The award is dispensed through SPE International to the winners

The scoring criterion is based on twenty points for the category of scholastic achievements, community service, and other honors, up to ten points based on the strength of the recommendation letters, ten points for previous employment history particularly if this involved composite activity, up to five points for filling out the application form correctly and using good English, five points for providing their transcript and for getting good grades, and a final five points for the reason they applied for the scholarship.

Award Requirements:

- Two awards presented to one undergraduate and one graduate student, who will maintain the academic status for at least two semesters after award announcement.
- An essay documenting experience in the composites industry is required (courses taken, research conducted, or jobs held)
- Have not received the award in previous years.
- Winners are typically students who not only maintained a good grade point average but also served their community, had some experience in the composite area, and are backed by solid reference letters from former professors and employers

The award can be up to $3500 per student depending on funding availability.

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This Issue:

Award Report continued...

Key Dates:

Issue call for nominations ....February 1st
Close call for nominations ....April 30th
Complete award adjudication ..... June 30th
Notify recipients by .... July 30th
Present awards SPE ACCE

Dr. Jackie Rehkopf Memorial Scholarships
This award is in honor of the late Jackie Rehkopf who was a recognized engineer who published books and was actively involved in the composites industry. The Automotive and Composites Divisions co-sponsor this award and therefore co-coordinate. This award is presented annually at the SPE ACCE conference each fall and is a premiere award for exemplary performance.

Award Requirements

- A single full time graduate student or two undergraduate students if no grad students qualify
- Preference will be given to female students, but the best candidates will be selected
- Focus should be on research activities targeted to ground transportation composites technology
- Students must be in good academic standing and pursuing a degree in Polymer Science, Composites, Plastics, or a related Engineering discipline
- A 2-page essay is required showing planned work and how it will benefit composites in an automotive or other ground transportation application
- A letter of recommendation from the student's advisor or mentor is also required
- Scholarship recipients are required to present work at an SPE technical conference and/or have it published in an SPE technical journal

The award can be up to $5000 if one student is selected or up to $2500 per student if two are selected, depending on funding availability.

Key Dates

Issue call for nominations ....January 1st
Close call for nominations ....April 30th
Complete award adjudication ..... June 30th
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Present awards SPE ACCE

See page 19 for more details

SPE Junior Researchers

By: Eve Vitale, SPE Foundation Executive

SPE Junior Researchers at ACCE – A Success!

Thank you to the SPE Composites and Automotive Division for hosting SPE Junior Researchers – Class of 2025 – at the 2024 ACCE Conference. Students enjoyed a session with Dr. Leonardo Simon reviewing polymeric materials and talking about how to navigate college and a career in the plastics industry. They talked with the students who were competing in the poster contest and sat in a technical session. One of their favorite activities was walking the exhibit floor. They were surprised at how many exhibitors were willing to talk with them and answer their questions.

Hopefully, these high school seniors will be geographically close next fall so they can present their work at ACCE 2025.

For the 2024-2025 school year, the SPE Foundation has a new community partner in Metro Detroit for our SPE Junior Researcher program. This collaboration with the William D. Ford Career-Technical Center, Westland, MI will enhance our program's impact on students' and their educational and career pathways.

Students in the William D. Ford program use high-tech engineering technologies to invent, design, and build solutions that meet the needs of a technologically advancing world. Students learn core foundational skills for design processes, power, machines, quality, and fabrication. Students program and operate industrial robots and machines to create products from engineering blueprints and specifications and earn Licenses/Certification in:

- OSHA 10
- Snap On Precision Measuring Instruments
- American Heart Association Heartsaver First Aid, CPR, AED
- SACA

There are ten students, two BASF SPE Jr. Researchers, two Arkema SPE Jr. Researchers, and six Celanese SPE Jr. Researchers:

- Mechatronics students who are studying Robotics, Electronics, and Manufacturing
- SPE Junior Researchers will have over 12 hours per week to work on their chosen projects
- Enthusiastic instructor, Stacy Barnard, sees great value in adding polymeric materials science and plastics manufacturing to the curriculum
- A well-outfitted lab for students supported through grants from the federal and Michigan governments, as well as the Society for Manufacturing Engineers (SME)
- Strong connections for PlastiVan® visits to "feeder" middle and high schools in the district

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This Issue:

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SPE Junior Researchers continued...

This fall Jr. Researchers are getting materials and manufacturing education from Mark Richardson, SPE Foundation Director of Education, and will begin their projects in earnest in January. Chuck Jarrett, The Materials Group, is coordinating mentors for student projects. Students are working independently and in groups and some of their projects include:

1. Building a thermoformer, designing a mold and thermoforming an RC Car Body to compete in the SPE Thermoforming Division RC Car Race at the 2025 SPE Thermoforming Conference in Atlanta in May.

2. Working with recycled 3D printer filament to determine material properties in comparison with filament made with prime resin.

3. Designing and 3D printing end-of-arm tooling for the in-house Fanuc robot and comparing materials and prints. For this project students are working with Fanuc.

4. Building a circuit and designing and 3D printing a custom enclosure for that system.

5. Working to understand the property differences between prime and recycled versions of an automotive resin.

6. Working with donated Power Wheels vehicles to redesign seating and safety for disabled children for the Future Educators program at William D. Ford Career-Technical Center.

Ms. Barnard received a FlashForge Adventurer 5M Pro 3D Printer as part of the SPE Foundation Grant Program for the projects. The Foundation has found that 3D printing introduces students to plastics manufacturing and excites them by allowing them to see their designs manufactured quickly, allowing design iterations for improvement in function and appearance.

Your willingness to invest your resources and time in these students demonstrates your true commitment to our future workforce and we appreciate that!

If you are interested in supporting the work of the SPE Foundation you can visit give.4spe.org or email us at Foundation@4spe.org

This Issue:

Welcome New Board Members

SPE Composites BOD would like to welcome our new BOD Amanda Nummy

Amanda Nummy is a senior polymer engineer with a decade of experience in the automotive industry, trailblazing holistic design approaches to material selection and use, and integrating nature-inspired innovation. She holds a bachelor's degree in Polymer, Textile, and Fiber Engineering from Georgia Tech, a master's degree in Materials Science and Engineering from Wayne State University, and a master's degree in Biomimicry from Arizona State University. She also earned her Professional Certification in biomimicry, one of only 110 individuals globally to achieve this level of expertise in the emerging field, leading and facilitating a new design thinking methodology for sustainability and regenerative practices. She was recently named one of Plastics News Rising Stars, and honored as one of Georgia Tech's 40 Under 40 alumni. In her current role, she is responsible for plant support and application development of all plastic components for North and South America, and leads several global collaborations for fuel cell and battery electric vehicles. Notable experience throughout her career includes hydrogen and biomedical fuel cells, specialty textiles, nanomaterials, carbon capture, advanced processing and recycling technologies, reclaimed ocean plastics, automotive shredder residue circularity, thermal runaway test method development, and lightweight composites. She is the author of several papers published within the industry, and has given technical presentations, keynote speeches, and guest lectures to diverse audiences around the world, advocating for the thoughtful and responsible use of polymeric materials and alternative energy as part of the complex system of solutions that will be needed to ensure a sustainable future.

Amanda Nummy

This Issue:

SPE COMPOSITES

Welcome New Board Members

SPE Composites BOD would like to welcome our new BOD Srikanth Pilla

Dr. Srikanth Pilla is a Professor and Director of the Center for Composite Materials at the University of Delaware (UD-CCM) with faculty appointments in Mechanical Engineering, Chemical and Biomolecular Engineering, and Materials Science and Engineering. He is also the Founding Director of 'AIM for Composites,' a Department of Energy-funded Energy Frontier Research Center. Pilla also co-directs IDeAS Composites, an NSF National Research Traineeship program focused on training next-generation composite leaders.

Pilla earned his doctorate in Mechanical Engineering from the University of Wisconsin-Milwaukee with postdoctoral training from Stanford University. Before joining UD-CCM, Pilla held the ExxonMobil Employees Chair in Engineering at Clemson University and was the founding director of the Clemson Composites Center. Pilla also worked as an Assistant Scientist at the University of Wisconsin-Madison.

Srikanth Pilla

Pilla's research interests lie in the fundamentals and applications of sustainable and lightweight functional materials and manufacturing. He has co-authored over 150 peer-reviewed archival publications. His research is supported by NSF, DOE, USDA, DOD, and NASA, as well as several foundations and industries, including automotive OEMs and their suppliers. Pilla is a fellow of the Society of Plastics Engineers and is the recipient of the 2021 Green Chemistry Challenge award from the Environmental Protection Agency and the 2022 Team award from the Department of Energy Vehicle Technologies Office.

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This Issue:

ACCE Award Winning Paper

Using Thermokinetic Analyses for the Efficient and Accurate Optimization of Composites Molding

Dominik Dörr, Martin Hohberg, Stefan Haas, Alexander Bernath, Simutence GmbH, Germany

Abstract

Fiber-reinforced polymer composites offer significant potential for lightweight design due to excellent weight-specific mechanical properties. Manufacturing of composites, however, is challenging due to their complex thermokinetic and rheological material behavior. With an eye towards the fourth industrial revolution, modeling and simulation offer the opportunity to validate and optimize manufacturing processes virtually. In many cases, however, simulation approaches lack efficiency or accuracy. In this study, a real-time web service for thermokinetic analyses of composite manufacturing is presented. This enables efficient virtual manufacturing optimization through simplified prediction of through-thickness thermokinetics. Moreover, the initial temperature conditions for full-field molding simulation can be predicted, which has proven to increase prediction accuracy. Application examples are provided for both thermoforming of thermoplastic tape laminates as well as compression molding of LFT-tape-sandwiches.

Introduction

Lightweighting is an important enabler in the modern automotive industry for reducing greenhouse gas emissions and achieving future regulations [1]. Fiber-reinforced polymer composites offer significant potential for lightweight design due to excellent weight-specific mechanical properties. Manufacturing of composites, however, is challenging due to their complex thermokinetic and rheological material behavior. Manufacturing simulation can be adopted for virtual analysis and optimization of manufacturability. These full-field simulations, however, can be complex and time-consuming.

As a remedy, a simplified approach for thermokinetic analysis of thermoforming processes was developed at the Karlsruhe Institute of Technology (KIT) at the Institute of Vehicle System Technology (FAST) by Kugele [2]. This approach is implemented in Matlab and uses finite differences for quick prediction of the through-thickness temperature and crystallinity during thermoforming processes. Simutence, a spin-off company from KIT, has picked up this idea, implemented a finite element code for thermokinetic analyses, and developed a frontend to provide a web service for real-time thermokinetic analyses. The application is called SimuTherm and enables real-time analysis of curing cycles for given temperature histories as well as through-thickness analysis of thermokinetics during thermoforming processes with stacks of UD-tapes, GMT, or LFT-D. The thermoforming analysis covers the processing steps of transfer, open-mold cooling, closed-mold cooling, and dwell time (cf. Figure 1). In this study, the approach for modeling thermoforming processes, creating the required material cards, and application examples are presented.

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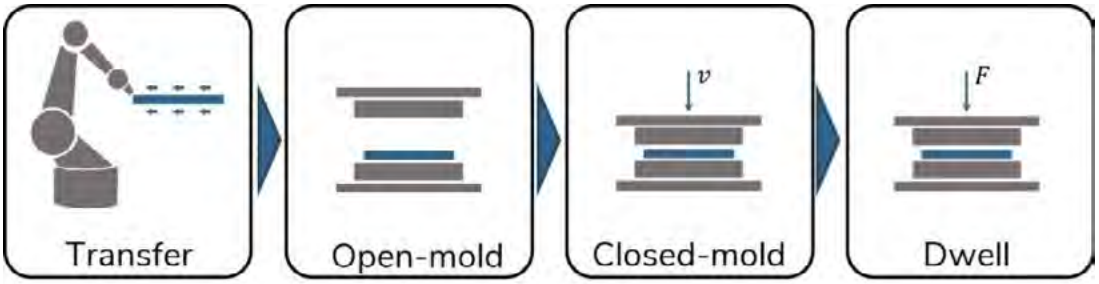

Figure 1: Schematic illustration of the thermoforming processing steps.

Approach for real-time thermokinetic analyses

With the goal of providing a modeling approach for real-time analysis of thermokinetics during thermoforming processes, SimuTherm uses a 1D through-thickness discretization to predict the evolution of temperature and crystallization kinetics. The 1D finite element discretization and boundary conditions are illustrated schematically in Figure 2.

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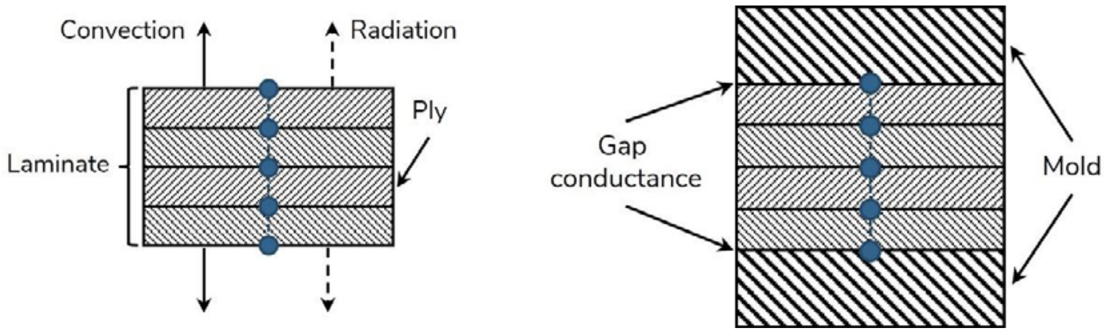

Figure 2: Schematic of the SimuTherm discretization approach for real-time through-thickness thermokinetic analyses of thermoforming processes

The governing equation for thermal modeling is the heat balance equation in combination with the generalized Fourier's law for heat conductivity, which is given in the strong form by [3]

(1) $$\rho c_\mathrm{p}\dot{T} = \mathrm{div}\big(\boldsymbol{\lambda}\cdot\mathrm{grad}(T)\big) + r.$$

Here, T is the temperature, ρ the material density, c_p the heat capacity, λ the heat conductivity tensor, and r a heat flux source term. For discretization through finite elements, the strong form of Equation 1 is transferred to the weak form

(2) $$\underbrace{\int_\Omega \rho c_\mathrm{p}\dot{T}\,\delta T\,\mathrm{d}V}_{\delta W^{\mathrm{cap}}} = -\underbrace{\int_\Omega \big(\boldsymbol{\lambda}\cdot\mathrm{grad}(T)\big)\cdot\big(\mathrm{grad}(\delta T)\big)\,\mathrm{d}V}_{\delta W^{\mathrm{cond}}} - \underbrace{\int_{\Gamma_\Omega} s\,\delta T\,\mathrm{d}A}_{\delta W^{\mathrm{surf}}} + \underbrace{\int_\Omega r\,\delta T\,\mathrm{d}V}_{\delta W^{\mathrm{source}}},$$

where s is the surface flux on the boundary Γ_Ω. The conductivity term δW^{cond} is adopted to model the through-thickness heat conductivity. In contrast, the surface flux is used to model either convection and radiation or the tool-ply gap conductance. Finally, the source term r is adopted to model the latent heat during crystallization.

Crystallization kinetics is modeled using Nakamura's equation [4], which is given in differential form by [5]

(3) $$\dot{\alpha}(t) = nK(T)\big(1-\alpha(t)\big)\ln\left[-\big(1-\alpha(t)\big)\right]^{\frac{n-1}{n}}.$$

Here, n is the Avrami index and K is the crystallization rate constant. Our previous study [6] has shown that the usually adopted Hoffmann-Lauritzen approach [7, 8] to describe the crystallization rate constant K fails to describe crystallization kinetics over a wide range of cooling rates. Therefore, Ziabicki's empirical approach [9] is adopted:

(4) $$K(T) = K_{\max}\exp\left(-\frac{4\ln(2)\,(T-T_{\max})^2}{D^2}\right),$$

where K_{max}, T_{max}, and D are a set of material parameters defined for a specific cooling rate. suitable to capture crystallization kinetics over a wide range of cooling rates.

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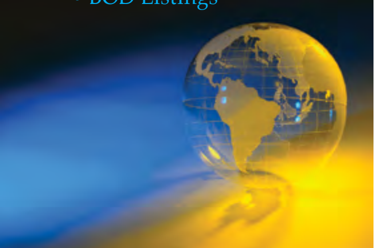

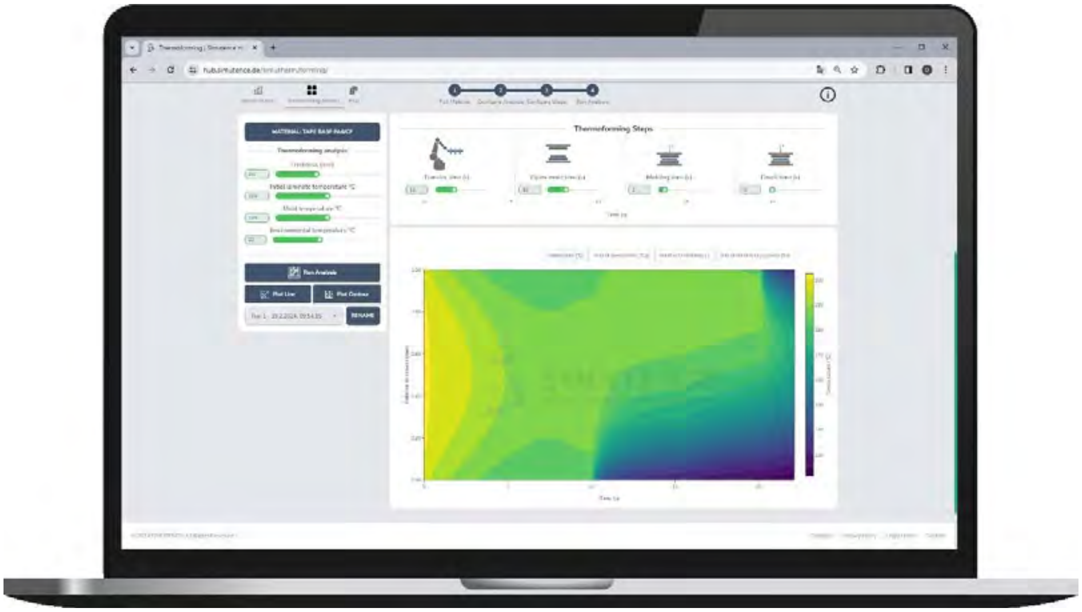

Figure 3: Screenshot of the SimuTherm user-interface for thermokinetic analysis of thermoforming processes.

SimuTherm is available as a web service through the so-called Simutence Hub (hub.simutence.de). Figure 3 shows a screenshot of the user-interface for thermoforming processes, providing an easy-to-use and intuitive interface including a material library. The interface enables the user to tweak processing parameters (initial laminate temperature, mold temperature, environmental temperature) and processing times (transfer time, open-mold time, molding time, and dwell time). Both laminates and stacks of multiple laminates or materials can be analyzed. The resulting history of temperature and relative crystallinity is obtained in real-time and can be investigated through contour and line plots.

Material Card Creation

The SimuTherm thermoforming analysis requires the characterization of heat capacity, material density, heat conductivity, and crystallization kinetics. Details on the adopted approaches for materials characterization and the determination of a material card are provided in the following.

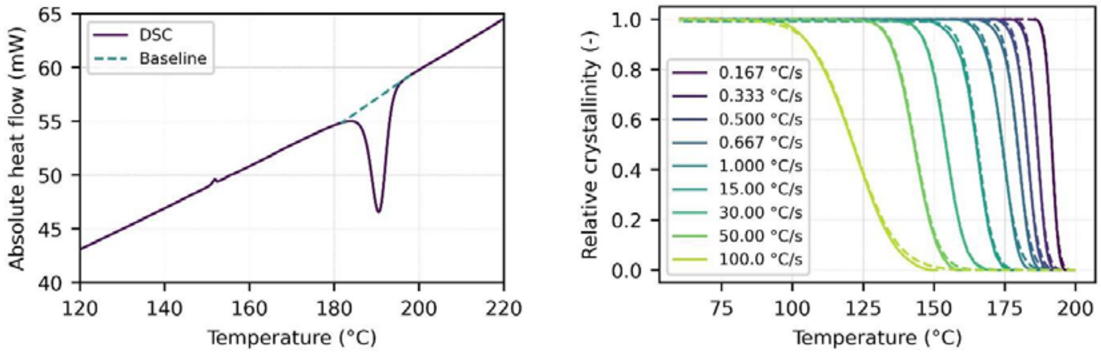

Figure 4: Characterization of relative crystallinity: Result from DSC at a cooling rate of 10 K/min (a) and resulting relative crystallinity including the fitting result for standard DSC (red) and flash DSC (blue) (b).

Heat capacity and crystallization kinetics

The temperature-dependent heat capacity and cooling-rate-dependent crystallization kinetics are characterized through Differential Scanning Calorimetry (DSC). For heat capacity characterization, different methods for characterization exist and basic approaches are standardized (ASTM E1269-11(2018)). Crystallization kinetics is characterized by using DSC and a combination of heating and cooling cycles. A moderate heating rate (10 K/min) is used for each heating cycle, whereas cooling rate is varied. Conventional DSC devices enable cooling rates up to 50 K/min, whereas fast-scan DSC enable cooling rates up to 150 K/min. Both are capable of characterizing weight-specific properties and therefore enable the determination of absolute crystallinity. In contrast, flash DSC use tiny specimens, enable cooling rates up to 1000 K/min and above, but are not capable of determining weight-specific properties. Thus, only the relative crystallinity can be determined.

Figure 4(a) shows an exemplary result of DSC measurement, including the crystallization peak and the baseline to extract the crystallization enthalpy. Based on the crystallization enthalpy, the relative crystallinity is determined, which is used for parameter identification of Nakamura-Ziabicki's equation (cf. Equation 3 and 4). The fitting result for a PA6/CF UD-tape (BASF Ultratape) based on a combination of standard and flash DSC measurements is shown in Figure 4(b).

Material density

The material density is required in the solid as well as the molten material state. Therefore, a capillary rheometer can be adopted to conduct isobaric pvT measurements (ISO 17744) at multiple elevated pressure states to enable a reliable measurement. The results are adopted to parametrize the two-domain Tait equation, which can then be used to extrapolate the specific volume to atmospheric pressure. Based on this, the temperature-dependent material density is obtained in the molten as well as the solid material state. On the one hand, the measurement can be conducted with a cryo-milled tape. On the other hand, if available, the neat thermoplastic can be used and the material density can be determined through subsequent homogenization.

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ACCE Award Winning Paper continued...

Heat conductivity

The heat conductivity is required, in analogy to material density, in the molten and solid material state. For the molten material state, usually a capillary rheometer is adopted (ASTM D5930). This approach, however, is feasible only for long fiber thermoplastics with a random fiber orientation. In contrast, the in-plane alignment of fibers in thermoplastic tapes, organosheets, non-woven thermoplastics or GMT hinder the utilization of a capillary rheometer. Therefore, measurement of the heat conductivity or using literature values for the neat thermoplastic and subsequent homogenization is suggested. For homogenization of the through-thickness heat conductivity, Hasselman's equation [10] can be adopted. Characterization of heat conductivity in the solid material state in contrast is straightforward and can be conducted e.g. by the transient plane heat source method (ISO 22007-2).

Processing steps and boundary conditions

The cooling experiments presented by Kugele et al. [6,11,12] are adopted for parameterization of the boundary conditions convection, radiation, and mold gap conductance. The experiments are conducted with PA6/CF UD-tape (BASF Ultratape) laminates with a [0;90] stacking sequence, square side length of 150 mm, and a thickness of 1 mm. Thermocouples of type K are incorporated into the laminate prior to preconsolidation of the laminates in a variothermal mold for local temperature measurement.

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This Issue:

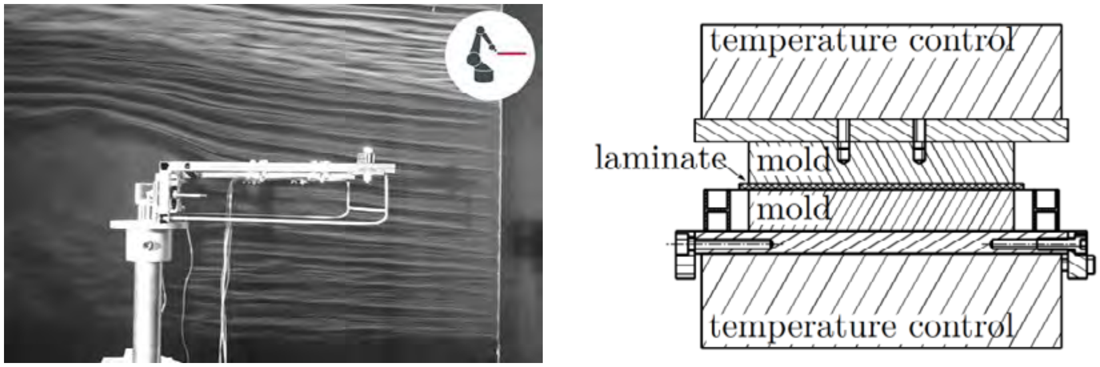

Figure 5: Experimental setups for characterization of cooling behavior: Cooling experiments in a wind tunnel [6,11] (a) and within a plane mold [6,12] (b).

Three different boundary conditions are considered for parametrization to mimic the boundary conditions during the different processing steps: Natural convection, forced convection and both-sided mold contact. For natural convection, the laminates are heated well above the melting temperature of the thermoplastic in a convection oven and cooled in a quiescent environment [6,11]. In contrast, a Göttinger-type windtunnel with open test section is adopted for forced convection, where the laminates are first heated above the melting temperature of the thermoplastic in the vicinity of the test section in a convection oven and then instantly moved to the free stream of the wind tunnel with 3 m/s and 5 m/s air speed [6,11]. The related test setup is shown in Figure 5(a).

For the both-sided mold contact, a plane mold mounted on a press is adopted (cf. Figure 5(b)). First, the laminate is heated inside a clamping frame in a convection oven above the melting temperature of the thermoplastic in the vicinity of the press. Subsequently, the clamping frame is transferred to the mold and placed on springs. This enables simultaneous both-sided contact while closing the upper and lower mold heated to 80 °C and applying a specific pressure of 0.06 bar.

The experimental results reveal a distinct influence of the different boundary conditions on cooling behavior, where the intimate mold contact induces the highest cooling rate. Nevertheless, a distinct influence of forced convection against natural convection is observed. Moreover, a distinct retardation of cooling due to the latent heat release during crystallization is observed. Regarding scattering, low standard deviation is observed for natural and forced convection. In contrast, standard deviation and cooling rate are high for the mold gap conductance, which smears and reduces the cooling retardation due to crystallization and thus the experimental determination of the onset of crystallization is prevented.

SimuTherm in combination with a material card for the investigated material is adopted to model the different setups for inverse identification of the parameters for convection and mold gap conductance. The correlation of the simulation results to the experimental results for the core temperature evolution is shown in Figure 6(a). The correlation of simulation to the experimental results for the core temperature reveals a good agreement for all boundary conditions. Beyond that, the onset of recrystallization as well as the retardation

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of cooling due to recrystallization is well captured, especially for forced convection. This is outlined in detail through the cooling rate and the resulting peaks due to crystallization in Figure 6(b). In simulation, the position of the onset, maximum, and end of the peak w.r.t. temperature (time) is determined by crystallization kinetics modeling, whereas the area under the peak is determined by the latent heat. A good agreement for the onset of crystallization is observed for forced convection. However, crystallization ends slightly too early in simulation, due to the symmetry of the crystallization rate constant in simulation and the non-symmetry of the peak observed in the cooling experiments. Nonetheless, the area under the peak is in good agreement. Regarding natural convection, a slight delay in the onset of recrystallization is observed. Here, it is to be noted that cooling rates observed for free and forced convection are between the ranges characterized by S- and F-DSC measurements conducted for this material. Nevertheless, the onset of crystallization is well described, which emphasizes in summary the suitability and validity of the applied crystallization kinetics modeling approach and related parametrization strategy, including an interpolation between S- an F-DSC measurements.

Application to virtual process optimization

Finally, two types of applications are outlined in the following. First, the application of SimuTherm for the analysis of a processing window for a thermoforming process with a thermoplastic tape laminate is presented. Subsequently, SimuTherm is adopted to predict the temperature profile for an LFT-tape-sandwich prior to molding for the accurate initialization of full-field molding simulation.

Thermoplastic tape laminates

The PA6-CF UD-tape (BASF Ultratape) outlined above is adopted for the application example. A laminate thickness of 2.0 mm, an initial sheet temperature of 300.0 °C, a mold temperature of 100.0 °C, and an environmental temperature of 23.0 °C are assigned. Moreover, a transfer time of 5.0 s, a molding time of 2.0 s, and a dwell time of 10.0 s is assumed. The open-mold cooling is varied in a virtual experiment to mimic a delayed press release. Here, 2.5 s and 10.0 s are considered for open-mold cooling time.

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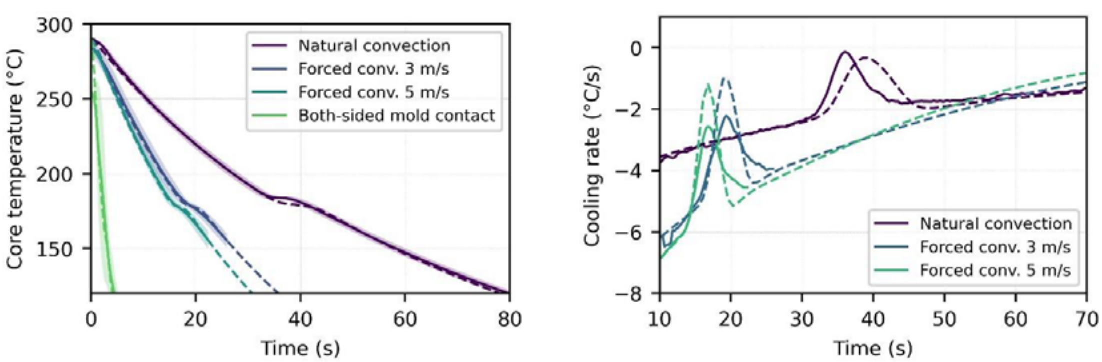

Figure 6: Comparison of experimental results from laminate cooling tests for PA6-CF [6,11,12] to simulation results including the prediction of crystallization and latent heat: Core temperatures (a) and cooling rates (b).

This Issue:

Figure 7 provides the results as contour plots for the temperature and relative crystallinity. The dashed lines indicate the transition between the different processing steps. The results reveal a significant temperature gradient rendered onto the laminate due to cooling. It is observed that crystallization at the surface during forming is inevitable for these processing settings. The increase in open-mold cooling time even leads to a significant increase in recrystallized cross-section during forming. Finally, it is observed that the adopted dwell time is sufficient to ensure a fully crystallized cross-section.

LFT-tape-sandwiches

LFT-tape-sandwiches are currently used for the protection against underbody impact events on the battery housing in BEV by some of the automotive OEMs. Using PP/GF tapes as skins and PP/GF LFT as core provides a significant potential for cost-efficient lightweight structures due to excellent weight-specific impact properties. Compression molding of these structures, however, is challenging due to size (1.5-3.0 m²), geometric stiffening, and functionalization features. In addition, commercially available simulation tools lack accuracy. One reason is the inappropriate consideration of the initial temperature profile at the onset of molding, which is determined through the sequence of heating, stacking, transfer, and placement of the semi-finished product inside the mold.

SimuTherm enables the prediction of the through-thickness temperature distribution at the onset of molding. A modular approach for predicting the cooling is pursued. First, cooling of the constituents can be predicted separately for transfer,

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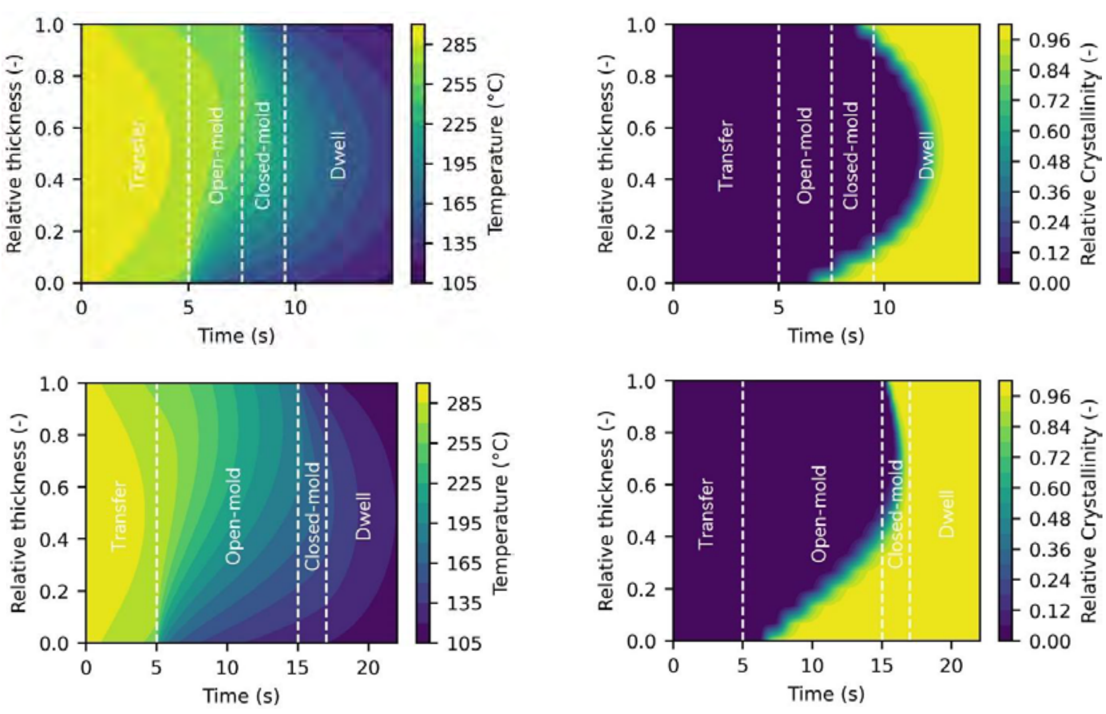

Figure 7: Prediction of the temperature and relative crystallinity for a thermoforming process with varying open-mold cooling time.

This Issue:

ACCE Award Winning Paper continued...

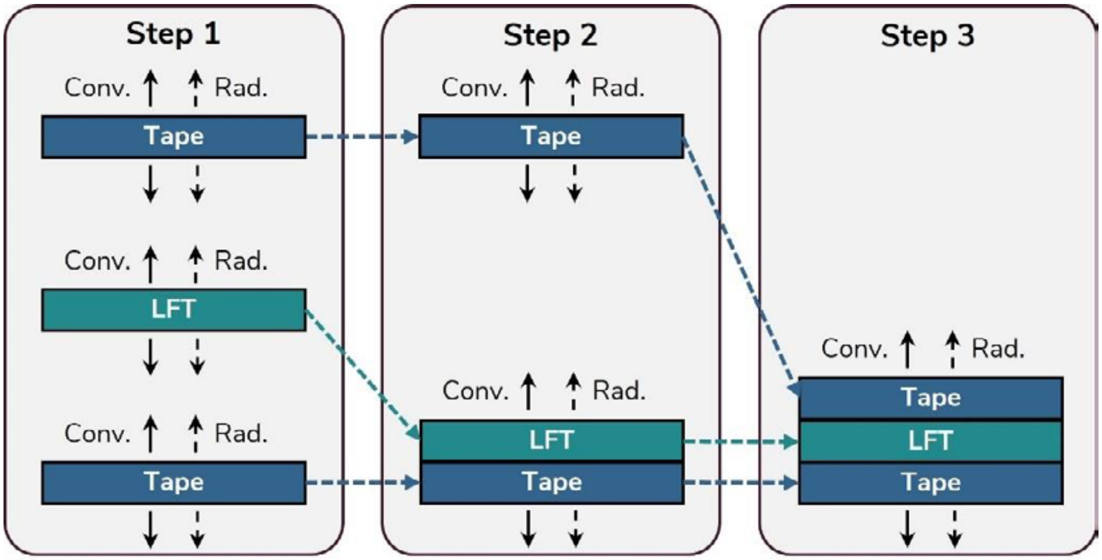

Figure 8: Schematic illustration of the cooling and stacking of the LFT tape sandwich before molding.

resting in quiescent environment, and open-mold cooling. Subsequently, the results can be combined as the initial temperature profile for predicting the cooling of the stacked sandwich. Based on this, the temperature profile at the onset of molding is predicted.

This approach was applied in the public funded project protECOlight for the prediction of the initial temperature profile for compression molding simulation of an LFT-tape-sandwich. The adopted part is a generic geometry designed by ElringKlinger AG, AUDI AG, Fraunhofer ICT, and Simutence GmbH to represent common features of underbody protections. The cooling and stacking sequence prior to molding is shown in Figure 8.

In the application for this study, the initial temperatures for the tape laminates and LFT are 220 °C and 230 °C, respectively. The results in Figure 9(a) reveal the significant temperature profile, which is rendered through the cooling and stacking sequence onto the sandwich. Significant cooler tape skins as well as a comparably

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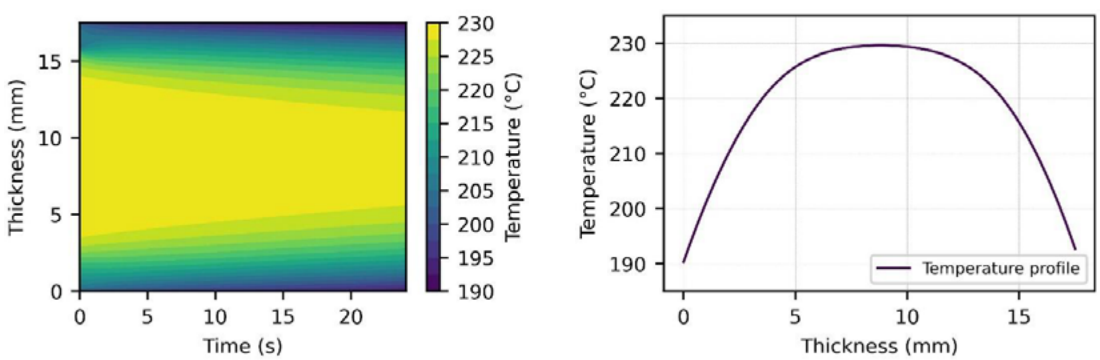

Figure 9: Results from step 3: Temperature contour plot (a) and final temperature profile (b).

This Issue:

ACCE Paper continued...

hotter LFT-D core are observed. This is also revealed by the temperature profile at the end of the cooling sequence shown in Figure 9(b). Here, in addition, a slight skewness with a slightly hotter top skin is observed.

An interface from SimuTherm to Moldflow was developed to enable the initialization of the temperature for full-field molding simulation. The tape skins are modeled in Moldflow as rigid part inserts and the through-thickness temperature predicted by SimuTherm is assigned as initial temperature. The LFT core is modeled in Moldflow through compression elements. Since Moldflow allows only the assignment of a global temperature for compression elements, the average through-thickness temperature is assigned.

The results from the molding simulation of a short shot are shown in Figure 10. The results reveal that the consideration of initial cooling yields shorter flow lengths. A difference of approximately 5 % in filled volume is observed, revealing the impact of initial temperature on flow behavior.

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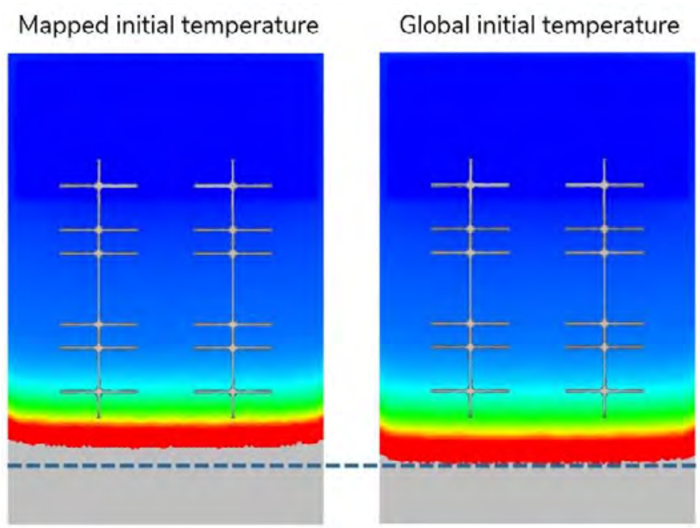

Figure 10: Comparison of results from short shot molding analysis with (left) and without (right) the consideration of initial cooling.

Conclusion and outlook

SimuTherm provides a promising approach for real-time thermokinetic analysis for virtual manufacturing optimization, based on a reasonable effort for material card creation as well as a negligible computational runtime. Moreover, the easy-to-use interface provides an opportunity for running simulations also to simulation laymen.

Component tests for the cooling behavior reveal that SimuTherm is capable of accurately predicting cooling behavior including crystallization kinetics for thermoforming processes. Moreover, the application results reveal that SimuTherm can be used to analyze the processing window as a function of the most relevant processing parameters. Besides this, SimuTherm is successfully applied for predicting the initial temperature prior to molding for LFT-tape-sandwiches. Here, it is shown that the initial temperature has a relevant impact on the predicted flow length, making this processing step essential for accurate full-field molding predictions. Related validation results will be presented in the near future.

As a next step, SimuTherm thermoforming analysis will be extended by an overmolding step so that the interface temperature and healing between is predicted. Moreover, the through-thickness prediction of thermokinetics will be extended for thermoset materials. Based on this, curing cycles can be optimized with a focus on heat introduced due to the exothermic reaction.

Acknowledgement

We acknowledges support from the German Federal Ministry for Economic Affairs and Climate Action within the TTP-LB project protECOlight.

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ACCE Award Winning Paper continued...

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This Issue:

This Issue:

SPE® Automotive Composites Conference & Expo (ACCE) 2024 Excels with Industry and Academia Innovations and Exchanges

FOR IMMEDIATE RELEASE: 1 NOVEMBER 2024
Media Contact: Teri Chouinard, SPE ACCE MarCom Chair, 248.701.8003, intuitgroup@gmail.com

SPE® Automotive Composites Conference & Expo (ACCE) 2024 included 72 Technical Presentations, 28 Student Posters, 43 Sponsorships, 29 Exhibits, 4 Keynote Addresses and a panel discussion on Sustainability and End of Vehicle Life.

In addition, more than $11,000 was awarded in student scholarships & 28 students were provided with free registrations and hotel accommodations

TROY (DETROIT), MICH. -

The SPE® Automotive Composites Conference & Expo (ACCE) event was held September 4 – 6, 2024, at the Suburban Collection Showplace Diamond Banquet and Conference Center in Novi, Michigan. It was the 24th annual SPE® ACCE produced by the SPE Automotive and Composites Divisions. It was a valuable event for exhibitors/sponsors and attendees representing OEMs, Tier Suppliers, Academia and other composites industry professionals.

"Globally, the SPE-ACCE event always brings together the 'best of the best' from academia and industry," said Peter McCormack, North American Sales Manager, Dieffenbacher. "For a few short days, this exchange is an invaluable arena for the composites sector," added McCormack.

"Thank you to the ACCE team for the excellent coordination of the ACCE; it was a great conference for our team, and we especially enjoyed the extra time allocated for multiple hour-long networking breaks to have meaningful customer interactions. The variety of workshops and keynote speakers provided valuable insights," said Michele Laperna Wong, Commercial Development Manager – Polymers & Coating at Imerys Performance Minerals Americas. "Overall, it was a well-organized and enriching experience that we look forward to attending again in the future," added Wong.

"All of the plastic and composite parts showcased at 2024 ACCE demonstrated innovation in numerous ways, reflecting the growth we strive for in our industry," stated Ankur Bhosale, Sr. Principal Engineer

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ACCE Post Show Press Release continued...

of Engineering Plastics at BASF Corporation. "The 2024 ACCE offered invaluable insights and remains the premier event where we all can learn from each other and elevate our plastics industry to new heights," Bhosale added.

ACCE Leadership & Summary:

"The 2024 ACCE attracted many long-time attendees and newcomers excited to drive innovation in composites for the future of transportation," said Dr. David Jack, Professor – Department of Mechanical Engineering at Baylor University and ACCE 2024 Co-Chair. "This year, because composites are the key to numerous mobility applications (beyond the road and moving into the air), our theme expanded to reflect composites as essential to "The Future of Transportation - Mobility and Beyond," added Jack.

"Composites are the most versatile, lightweight, and strongest materials for design freedom and multifunctionality, and due to recent advances in processing and manufacturing, their use has extended to numerous innovative applications," said Dr. Mike Siwajek, Vice President of Research and Development at Teijin Automotive Technologies.

A number of composite leaders from industry and academia provided additional direction and support for the event. The technical program included 72 presentations and was led by Dr. Mehdi Tajvidi, Professor of Renewable Nanomaterials, School of Forest Resources, Advanced Structures and Composites Center and Forest Bioproducts Institute at University of Maine and Dr. Dominik Dörr, Co-Founder & Managing Director of Simutence. Additional support was provided from Jitesh Desai, Program Treasurer, SPE Automotive Division. Dr. Leonardo Simon, Professor at the University of Waterloo, led the ACCE Parts Competition that included 4 nominations. Dr. Douglas Smith, Professor at Baylor University, Chair of Student Engagement, led the Student Poster Competition that included 28 presentations with sponsorship support provided by Dassault Systèmes. This year we included five minute presentations with all student posters, and was well received by everyone. Teri Chouinard, President of Intuit Group, provided leadership as ACCE Sponsorship Chair with 43 sponsorships and 29 exhibits and provided Admin support for the Technical Program and Event Management overall.

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ACCE Post Show Press Release continued...

Keynotes presented at the ACCE 2024 event included: “Beyond Carbon-Neutral Mobility-Sustainability in the Volkswagen Group Innovation” by Dr. Hendrik Mainka, Principal Program Lead Innovation Hub Knoxville, Volkswagen Group of America, Inc., “High Performance Composites: Trends and Impact on Automotive Lightweighting” by Andrew N. Hrymak, Co-Director of the Fraunhofer Innovation Platform for Composites Research at Western University and Professor of Chemical and Biochemical Engineering, “Innovation to Impact: Advancing Transportation Through The Intersection of Sustainability and Polymer Composite Technology” by Amanda Nummy, Senior Materials Engineer, Sustainable Materials at Hyundai America Technical Center, and “50 Years of Innovation at the University of Delaware’s Center for Composite Materials” by Dr. Srikanth Pilla, Professor and Director of the University of Delaware’s Center for Composite Materials (UD-CCM).

A Panel Discussion on Sustainability and End of Vehicle Life, “Breaking Down the Barriers to a Circular Automotive Economy,” was moderated by Adam Halsband, Managing Director at Forward Engineering North America. Panelists including Dr. Hendrik Mainka, Senior Project Lead and Head of Innovation Hub Knoxville at Volkswagen of America; Dr. David L. Wagger, Chief Scientist/Director of Environmental Management at Recycled Materials Association (ReMA); Mr. Brad Allen, OEM Automotive Account Manager at Rebuilders Automotive Supply (RAS); and Mr. Marco Meloni, Chief Operating Officer at Plastics Recycling, Inc. (PRI) provided valuable insights and solutions for composites compatibility in a circular and sustainable system.

The ACCE 2024 technical program included 72 presentations on advances in the following categories: Composites in Electric Vehicles; Advances in Thermoplastic Composites; Advances in Thermoset Composites; Additive Manufacturing/3D Printing; Enabling Technologies; Sustainable Composites; Bonding/Joining/Finishing; Design, Modeling, and Simulation of Composites; and Celebration of the 50 Years of the Center for Composite Materials.

David Jack, ACCE 2024 Co-Chair

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ACCE Post Show Press Release continued...

Exhibitor Floor of ACCE 2024

Best Paper Awards:
Excellence in technical writing is recognized annually at ACCE by honoring those who have presented the best papers at the conference. The 2024 Best Paper Award winners received the highest average ratings by conference peer reviewers, including members of the ACCE planning committee and other industry experts. First, second, and third place winners were recognized and honored at the event in the "Best Paper Award" competition.

Tanzila Minhaj, North Carolina A&T State University, won the Best Paper Award for her paper "Assessment of Damage Evolution in Thermoplastic Composite Using Acoustic Emission and CNN-LSTM Mode." Second place recognition was awarded to Rachel Van Lear, PhD student at Baylor University, for her paper "Sound Predictions: Correlating Impact Damage to Laminate Compressive Strength with Phased Array UT." Third place recognition was awarded to Dr. Martin Hohberg, Simutence GmbH for his paper on "Using Thermokinetic Analyses for the Efficient and Accurate Optimization of Composites Molding".

At the conference, the authors received certificates, and their papers were highlighted in the ACCE program schedule. Their papers will also be published in the SPE Automotive and Composites Division newsletters and other industry publications.

Student Poster Competition:
Students from the United States and Canada featured innovative research related to polymer composite materials and manufacturing technologies for automotive applications via the annual ACCE Poster Competition. This yearly event enables students to meet with industry professionals and learn about career opportunities as a scientist, engineer, researcher and other professions in the field. Automotive OEMs, tier suppliers, and others appreciate the introduction to the next generation of automotive composites engineering professionals and the opportunity to potentially hire them in the future. The 2024 ACCE Student Poster Competition, sponsored by Dassault Systèmes, included 28 posters from six different universities. This year's winners are:

Graduate Category:
1st Place: "Hybrid Carbon/Metal Composites for Lightning Strike Protection in Advanced Air Mobility Vehicles" Hridyesh Tewani, U of Wisconsin - Madison

2nd Place: "Sound Predictions: Correlating Impact Damage to Laminate Compressive Strength with PAUT" Rachel Van Lear, Baylor University

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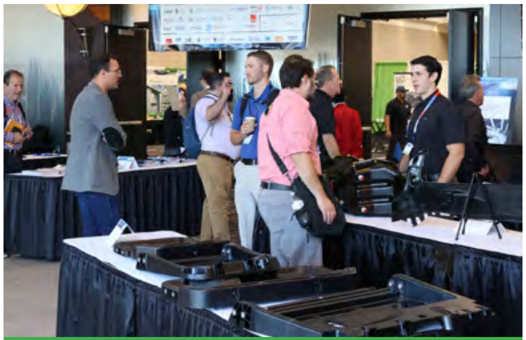
Exhibitor Floor of ACCE 2024



Exhibitor Floor of ACCE 2024

3rd Place: "Simulating the Effect of Bead Microstructure on Thermal-Mechanical Response in Multi-Bead Structures for Large Area Additive Manufacturing of Short Carbon Fiber/ABS" Neshat Sayah, Baylor University

Undergraduate Category:

1st Place: "AI-Driven Sustainable Fused Deposition Modeling of Sustainable Composite For Automotive Applications: A Bayesian Optimization Approach" Philip McMorran, University of Guelph

2nd Place: "Effects of Repetitive Recycling on the Performance of Sustainable Biocarbon Polypropylene Composites" Sarah Simoes, University of Guelph

3rd Place: "Effect of Blend Ratio and Compatibilizer on rPP/rLLDPE Sustainable Miscanthus Biocarbon Reinforced Composite" Cameron Marquez, University of Guelph

Scholarship Awards:

The organizing committee for the SPE Automotive Composites Conference & Exhibition (ACCE) honored the winners of the group's annual SPE ACCE scholarships and the Dr. Jackie Rehkopf scholarships from a fund that has been set up to honor the longtime SPE ACCE committee member, SPE Automotive Division board member, and automotive composites researcher. ACCE scholarship winners will plan to present the results of their research at the next year's SPE ACCE event, Sept. 3 - 5, 2025. Rehkopf scholarship winners will present the results of their research at next year's SPE ACCE or publish them in an SPE journal. Both scholarships are administered as part of the SPE Foundation (www.4spe.org).

The ACCE Scholarships (a total of $6,000 USD) are sponsored by the SPE Automotive and SPE Composites Divisions. Five ACCE Scholarships ($500 - $2,000 USD each) are awarded to students pursuing advanced studies in a composites-related field. The five winners of the SPE ACCE scholarships are Kuthan Celebi, a PhD student in Materials Engineering at the University of British Columbia in Vancouver, Canada awarded $2,000; Uday Kiran Balaga, a PhD student in focused on Composites Recycling at the University of Delaware Center for Composite Materials in Newark, Delaware, USA also awarded also awarded $2,000; Md Amay Amif, a PhD student in the Department of Mechanical Engineering at Baylor University in Waco, Texas, USA awarded $1,000; Seyedshahabaldin Amirabadi, a PhD student in Mechanical Engineering at the University of Toronto, in Toronto, Canada awarded $500; and Elife Kildali, a PhD student in Bioengineering at the Bursa Technical University in Bursa, Turkey also awarded $500.

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ACCE Post Show Press Release continued...

The Dr. Jackie Rehkopf scholarships are sponsored by the SPE Automotive Division, the SPE Composites Division and the generous donations of friends and family. The three winners selected this year for the Rehkopf Scholarship ($1,250 - $2,500 USD each) are Paula Hohoff, Chief Engineer of the Polymer Engineering Center at UW-Madison in Madison, Wisconsin, USA awarded $2,500; Meng Jiang, a Taohist and a chemist at Worch Lab at Virgina Tech in Blacksburg, Virginia, USA awarded $1,250; and Dhanashree Shinde a PhD student at the University of Delaware Center for Composite Materials in Newark, Delaware, USA also awarded $1,250.

Part Competition:

This year's ACCE Part Competition was led by Dr. Leonardo Simon from the University of Waterloo, who previously served as the 2021, 2022 and 2023 ACCE Co-Chair. A panel of automotive composites industry experts, from industry and academia, studied the 4 nominations that were submitted in advance of the event and reviewed the parts onsite and voted for the Most Innovative Material and/or Process Applications in Production Part and Prototype Part Categories. Nominations were judged on the impact and trendsetting nature of the application, including materials of construction, processing methods, assembly methods, and other enabling technologies that made the application possible. Nominations emphasized the benefits of design, weight and cost reduction, functional integration, and improved performance. A separate prize, the People's Choice award, was selected by vote of conference attendees.

Here are the winners:

1. Most Innovative Part in the Process Innovation - Prototype Part Category:

Cost -Effective Lightweight Vehicle Body Structures nominated by WEAV3D with support from Braskem.

2. Most Innovative Part in the Process Innovation – Production Part Category:

Largest Known Injection Molded Polyamide Hydraulic Tank, An Alternative Technique to Roto-Molding for a 2024MY Compact Excavator (Utility/Construction Vehicle) nominated by BASF Corporation with support from Bemis.

3. People's Choice Award:

Continuous Fiber Thermoplastic Sandwich Structure For Next Generation Toyota Tacoma Service Hole Cover – A Process Innovation in the Prototype Part Category - Nominated by: Fraunhofer Innovation Platform for Composites Research at Western University with support from Simutence and Aerlyte.

4. Honorable Mention in the Process Innovation – Production Part Category:

Toyota Tacoma Second-Row Optimized Sear Structure nominated by BASF Corporation with support from USF US Farathane.

ACCE Sponsors:

The 2024 SPE Automotive Composites Conference & Expo (ACCE) was made possible by the support of Sponsors including:

Premier Plus Sponsor: Molding Products
Premier Sponsors: AOC, BASF, BOSTIK Adhesives, Forward Engineering, INEOS Composites, KATCON Advanced Materials, and Westlake Epoxy

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Associate Sponsors: Avient, Baylor University MTACC, Composites One, Dieffenbacher, Fagor Arrasate, Fraunhofer at Western University, IACMI, IDI Composites, IMERYS, Johns Manville, Owens Corning, LyondellBasell, Rassini, Schmidt & Heinzmann, James Cropper (formerlyTFP), Tangho, Trimer, Vartega, and Vectorply

Table Top Sponsors: SPE Automotive Division, SPE Detroit Section, SPE Thermoset Division

Poster Competition Sponsor: Dassault Systèmes

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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 on ACCE 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 www.4spe.org.

The next ACCE is scheduled for Sept. 3 – 5, 2025 at the same venue as the 2024 event - the Suburban Collection Showplace Diamond Banquet and Conference Center in Novi,Michigan. An "Early Bird Discount" is available to sponsors who commit to supporting the ACCE 2025 event in 2024 and process payment by December 31, 2024. For more info contact Intuitgroup@gmail.com

Attention Editors: Photos are available for download via Flickr: https://flic.kr/s/aHBqjBMvPN

This Issue:

Thermosets: Setting New Standards

For Immediate Release: 14 NOVEMBER 2024
Media Contact: Teri Chouinard, SPE Thermoset TopCon Event Manager, 248.701.8003, intuitgroup@gmail.com

SPE® Thermoset Div. Announces Call For Papers, Sponsors & Exhibitors For Thermoset Topcon May 13-14, 2025, In Madison, Wisconsin

Abstracts Due February 15, 2025 &
Final Presentations Due April 15, 2025

The SPE Thermoset Div. is announcing its call for papers, exhibitors, and sponsors for their annual event to be held on May 13 – May 14, 2025, at the Monona Terrace and Convention Center in Madison, Wisconsin.

"THERMOSETS: SETTING NEW STANDARDS" is the theme for the 2025 event. "This year's theme highlights how thermoset material and manufacturing technologies are 'Setting New Standards' as the best solution for innovating new products, and improving performance, mechanical properties, and costs in a number of applications and markets," said Sean Campbell, sales and marketing manager, Engineered Composites at LyondellBasell and SPE Thermoset Div. Chair. "Thermoset plastics are known as the standard for high-heat applications such as electronics and appliances and where high strength-to-weight ratio, chemical inertness, dimensional stability and structure are important including aerospace, construction, transportation and more," added Campbell. "Today, thermosets are expanding increasingly into electrical vehicles, urban air mobility, mass transit, oil and gas, medical devices, civil engineering infrastructure and more," continued Campbell.

The SPE Thermoset TopCon 2024 event was a huge success with 170 attendees (largest attendance in recent years), 27 sponsors, two keynote presentations, 21 technical talks and great networking during two breakfasts, two lunches and a fun cocktail reception with a band overlooking the beautiful Lake Monona. Students presented their research and development in thermoset technology via student posters and were awarded cash prizes. A $7,500 donation was made to the SPE Foundation to support STEM student programs.

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This Issue:

Thermosets: Setting New Standards

The SPE Thermoset TopCon 2025 will follow the 2024 format featuring keynotes, technical presentations and exhibits highlighting advances in materials, processes, and equipment for thermoset technologies in multiple applications. The 2-day conference also includes networking breakfasts, lunches, and a cocktail reception. Optional social events, including a tour of the Polymer Engineering Center at UW – Madison, golf outing at University Ridge Golf Course and a cruise of the Madison shoreline are offered on May 12, the day before the conference begins.

Paper abstracts are due February 15, 2025, and final presentations are due April 15, 2025. Limited time slots are available. A variety of exhibit and non-exhibit sponsorship packages including passes to the event and opportunities for company exposure are available. Companies interested in presenting papers and/or showcasing their products and/or services via sponsorship or exhibiting, and individuals interested in registering to attend the event should go to https://spethermosets.org/topcon/ for more information or contact Teri Chouinard at intuitgroup@gmail.com.

Conference Venue: Inspired by Wisconsin native Frank Lloyd Wright's design, at the peak of his creative powers in 1938, the Monona Terrace Community and Convention Center is one of the country's premier conference and convention facilities. On the shores of Lake Monona, it is an architecturally striking structure that connects the state capital, the cityscape, and the community. The conference exhibits, meals and cocktail reception will be in the Community Terrace with pristine views of Lake Monona offering a relaxing and enjoyable experience. The presentations will be in the Lecture Hall offering comfortable theatre style seating, staging and professional audio-visual support. Special rates are provided for conference attendees at the Hilton Madison Monona Terrace which is connected via skywalk to the conference venue. See https://www.mononaterrace.com and https://www3.hilton.com/ for more info.

SPE Thermoset TopCon 2024 Sponsors included: Plenco (Plastics Engineering Company); Mar-Bal, Inc.; IDI Composites International; LYB LyondellBasell; American Colors Inc.; Century Tooling; Core Molding Technologies; Cimbar Performance Minerals; Composites One; Glenwood Tool & Mold, Inc; G & W Electric; ICT Molding Solutions; INEOS Composites; McClarin Composites; Molding Products; sensXPERT Technology by NETZSCH; Neptune Nano Technologies; OMYA; Owens Corning; Penn Compression Moulding, Inc.; Premix Hadlock; Zehrco-Giancola Composites; Schmidt & Heinzmann; Vibrantz Technologies; CompositesWorld; Plastics News; and Urethanes Technology International.

The mission of SPE is to promote scientific and engineering knowledge relating to plastics and composites worldwide and to educate industry, academia, and the public about the technological advances. SPE's Thermoset Division is active in educating, promoting, recognizing, and communicating technical accomplishments in thermoset technology in multiple industries. Topic areas include applications, materials, processing, equipment, tooling, design, and development.

For more information see
https://spethermosets.org/topcon/.
For more information on the Society of Plastics Engineers, see
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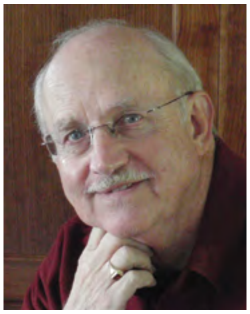

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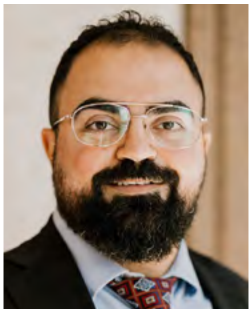

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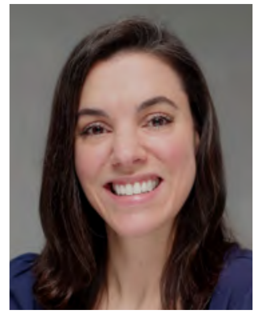

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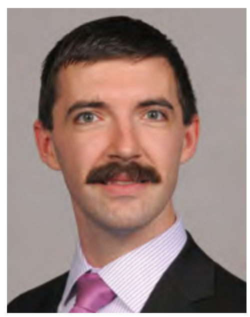

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