

VDI

K

Plastics in Automotive Engineering

KUNSTSTOFFTECHNIK

Plastics in Automotive Engineering

Herausgeber: VDI Wissensforum GmbH
VDI-Gesellschaft Materials Engineering

Bibliographische Information der Deutschen Bibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliographie; detaillierte bibliographische Daten sind im Internet unter <http://dnb.ddb.de> abrufbar.

Bibliographic information published by the Deutsche Bibliothek

(German National Library)

The Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliographie (German National Bibliography); detailed bibliographic data is available via Internet at <http://dnb.ddb.de>.

© VDI Verlag GmbH · Düsseldorf 2017

Alle Rechte, auch das des auszugsweisen Nachdruckes, der auszugsweisen oder vollständigen photomechanischen Wiedergabe (Photokopie, Mikrokopie) und das der Übersetzung, vorbehalten.

Printed in Germany

ISBN 978-3-18-234348-6

Foreword

Engineering plastics, fiber-reinforced composites and multifunctional plastic composites provide ongoing support to the modern automotive industry today.

In many cases multi-functional tools and automated processes make particularly economic system solutions possible. Additive manufacturing in combination with plastics already has a great potential today for producing individual, tailor-made component concepts, above all for small production runs.

Lightweight construction, an attractive look and feel for the interior, and active and passive safety stand right at the forefront of new automotive developments today. Innovations in plastics technology have a direct influence on tomorrow's vehicle concepts. Mixed construction with plastic composites, natural fiber applications, overmolded and in-mold film laminated parts, LED- and OLED-based lighting technologies, and also optically and haptically optimized display and operating concepts make tailored system solutions possible in both passenger cars and commercial vehicles and thus secure in the long term the international competitiveness of the plastics and automotive industries.

The Association of German Engineers invites you to Mannheim on the 29th and 30th March 2017 for the annual international plastics conference 'Plastics in Automotive Engineering 2017'. Overview presentations on resource efficiency from research and the market, technical reports on innovations in plastics from the car and commercial vehicle sectors, as well as practical reports from plastics processing provide detailed information on the current state of the art in plastics technology in automotive engineering. An exhibition involving plastics producers and machinery manufacturers as well as an affiliated motor show with the latest cars and commercial vehicles provide a focus for an exchange of specialist information at the object itself.

May we cordially welcome you to Mannheim!

Prof. Dr. Rudolf C. Stauber

Table of Contents

Plenary Session

Future 2050: technological trends in an era of sustainability and smart machines

Dr. U. Eberl, SciPress, Höhenkirchen/Munich

1

Interior

Sewn-covering lamination for the instrument panel: from the discontinuous to the continuous process

R. Kurz, S. Hobelsberger, H. Auer, BMW AG, Landshut

13

Methodological further development of weight reduction in vehicle interior trim parts – Current and future opportunities from an automaker's perspective

M. Steinbach, J. Maier, Adam Opel AG, Rüsselsheim

21

New vinyl ink and robotized digital printing process for the fine decoration of an instrument panel made by PVC slush molding

Dr. N. Amouroux, M. El Fouzari, IVY Group, Reims, France

35

New surfaces and difficulties in applying existing test methods

Dipl.-Ing. J. Guenther, Dipl.-Ing. D. Malecha, J. Reinicke, B.Eng., Kunststoff-Institut Lüdenscheid, Lüdenscheid

45

Exterior

The underbody: an underestimated contribution to CO₂ reduction

O. Mende, Volkswagen AG, Wolfsburg

57

Bumper in thin-wall technology: an update regarding materials, processes, and technology innovations

Dipl.-Ing. J. Götzelmann, Magna Exteriors, Sailauf;

Dipl.-Ing. P. Diehl, Magna Exteriors, Esslingen

75

Development of a filler-cap hinge made of recycling material

M. Thurmeier, M.Eng., C. Horbas, Dipl.-Ing. (FH) F. Wagner, AUDI AG, Ingolstadt

91

Lightweight material with class – Rear apron made of extremely low density polyurethane	
<i>Dipl.-Ing. (FH) C. Bauernfeind, Dr. Ing. h. c. F. Porsche AG, Weissach;</i>	
<i>Dipl.-Ing. E. Bleeß, Polytec Group (Polytec Car Styling), Hörsching, Österreich</i>	93
Active aerodynamic advancements in vehicle underbodies	
<i>A. Povinelli, M. Matthews, Magna Exteriors, Troy, Michigan, USA;</i>	
<i>Dr. J. J. Laux, Magna Management, Cham, Switzerland;</i>	
<i>J. Goetzelmann, Magna Exteriors, Sailauf</i>	101
Improved crash simulation of endless-fiber-reinforced thermoplastics – organic sheets	
<i>Dipl.-Ing. M. Franzen, Ford Werke GmbH, Research & Innovation Center Aachen, Aachen; Dipl.-Ing. G. Oberhofer, MATFEM Partnerschaft Dr. Gese & Oberhofer, Munich; Dipl.-Ing. R. Schwarzer, Kirchhoff Automotive Deutschland GmbH, Attendorn</i>	109
 Methods	
Innovative processing of thermoplastic composites for the Porsche Panamera brake pedal – Continuous-fiber technology for safety components in the vehicle	
<i>Dipl.-Ing. D. Häffelin, BOGE Rubber & Plastics, Damme</i>	121
Energy-efficient production of thermoplastic CFRP parts by one-step direct processing	
<i>Dr.-Ing. J. Reddemann, Dr.-Ing. H. Seifert, AUDI AG, Ingolstadt</i>	135
3-D direct deposition of reinforcement fibers in the fiber blowing process – State of the art in natural fiber processing	
<i>R. Korn, M.Sc., BMW AG (via AlphaKraft GmbH), Munich;</i>	
<i>Dr.-Ing. T. Reußmann, TITK e.V., Rudolstadt</i>	145
It doesn't get greener than this! – Sustainable, economical, safe: engineering recycles for the automotive industry	
<i>Dipl.-Ing. A. Hoffmann, Hoffmann + Voss GmbH, Viersen</i>	157
Tinuvin® 880 – novel light stabilizer for automotive interior applications	
<i>Dipl.-Ing. G. Huber, BASF, Basel, Switzerland</i>	161
Characterization of microcellular plastics for weight reduction in automotive interior parts	
<i>Dr. J. Gómez-Monterde, SEAT SA, Martorell, Spain;</i>	
<i>Dipl.-Ing. J. Hain, Volkswagen AG, Wolfsburg;</i>	
<i>Prof. Dr. M. Ll. MasPOCH, Centre Català del Plàstic / Universitat Politècnica de Catalunya-BarcelonaTech, Terrassa, Barcelona, Spain</i>	165

Simulation

A demonstrator for the experimental assessment of the through-process modeling of injection-molded parts made of short-fiber-reinforced polymers

*E. Spini, RadiciGroup Performance Plastics, Chignolo d'Isola (Bergamo), Italy;
A. Bernasconi, Politecnico di Milano, Milan, Italy*

179

Surface quality: improving the quality perception of molded parts

*PhD candidate P. Gamonal-Repiso, Dr. J.M. del-Mazo,
SEAT S.A, Martorell, Spain;
Prof. Dr. M. Sánchez-Soto, Centre Català del Plàstic/Universitat
Politécnica de Catalunya-BarcelonaTech, Terrassa/Barcelona, Spain*

191

Technology

Lightweight design at Volkswagen

*Dr.-Ing. P. Hörmann, Dipl.-Ing. (FH) K. Bornemann, Dr.-Ing. F. Flueggen,
Dipl.-Ing. H. Herten, Dr.-Ing. V. Hohm, Dr.-Ing. T. Ströhlein,
Volkswagen AG, Wolfsburg*

203

Hollow profiles, organo-sheets and LFRT node structures: hybrid components made of fiber-reinforced plastics for automotive serial production

*A. Liebsch, R. Kupfer, M. Gude, Institut für Leichtbau und Kunststofftechnik,
Technische Universität Dresden;
P. Müller, N. Andricevic, Dr. Ing. h.c. F. Porsche AG, Weissach*

215

FRP in the Materials Data Space, digitization of material competence as a supplement to Industry 4.0

*Dr.-Ing. R. Schlimper, Dr.-Ing. M. Zscheuye,
Prof. Dr.-Ing. P. Michel, Fraunhofer Institute for Microstructure of
Materials and Systems IMWS, Halle (Saale)*

227

Two-component air-guide panel manufactured by co-molding and foaming using core-back technology

*Dr.-Ing. A. Roch, A. Menrath, Department of Polymer Engineering, Fraunhofer
Institute for Chemical Technology ICT, Pfinztal;
B. Schmid, BBP Kunststoffwerk Marbach Baier GmbH, Marbach am Neckar*

229

Materials & Methods

- High-performance polypropylene: does PA 6 still have a future?**
Dipl.-Ing. H. Häberle, MAN Truck & Bus AG, Munich 231
- Electrochemical corrosion and its prevention with polyamides**
*Dipl.-Ing. G. Prautzsch, Dipl.-Ing. T. Stier, Dipl.-Ing. T. Coeln,
AKRO PLASTIC GmbH Niederrissen* 241

Plenary Session

- Application of organo-sheets in underbody components: cost- and weight-optimized off-road package**
Dipl.-Ing. (FH) R. Apfelbeck, S. Müller, B.Eng. (BA), AUDI AG, Neckarsulm 245
- Interior concepts: vehicle interior design developments relevant to the future**
J. Friedrich, Car Men GmbH, Idstein 257

3rd VDI Conference

Plastics in Commercial Vehicles

Lightweight Design

- Lightweight design for increased payload: new ways using polymer composites and physical foaming**
*L. Jerpdal, M.Sc. M.E., Dipl.-Ing J. Hain, Dr.-Ing. Dipl.-phys. O. Träger,
Volkswagen Konzernforschung, Wolfsburg* 259
- Lightweighting with carbon: lighter and cheaper than steel – Holistic consideration of the lightweighting potential and process costs of CFRP**
Dipl. Wiss.-Ing. G. Kalkoffen, CarbonTT, Stade 261
- Development of a carbon-composite electro-transmission housing**
*Dipl.-Ing. (FH) M. Kreuzmann, Dr. T. Schneider,
Dipl.-Ing. R. Rademacher, P+Z Engineering GmbH, Munich* 263

Cost Reduction

- The use of an alternative material for engine encapsulation for Trucks**
T. van den Einden, DAF Trucks, Eindhoven, The Netherlands;
Dipl.-Ing. Klaus Menke, Head of R&D, Johann Borgers GmbH & Co., Bocholt 271
- A new analytical calculation method for the injectionmolding process of a composite luggage rack holder**
M. Bakkal, Istanbul Technical University, Istanbul, Turkey;
O. Otuz, M.Sc., S. Dođru, M.Sc., Mercedes-Benz, Istanbul, Turkey 279
- True confidence in thermoplastic composite simulations for any automotive component**
W. Schijve, G. Frāncato, R.Yaldiz, SABIC, Geleen, The Netherlands 299
- Cost efficiency through the use of UV-resistant plastics in dynamically and statically highly-stressed components**
Dipl.-Ing. (FH) C. Bauer, Dipl.-Ing. (FH) H. Hāberle, MAN Truck & Bus AG, Munich 313
- Lightweight carrier system for the air filter of the Mercedes-Benz Actros**
Dipl.-Wirt.-Ing. (FH) H. Hauke, BBP Kunststoffwerk Marbach Baier GmbH, Marbach am Neckar; Dipl.-Ing., Dipl.-Wirt.-Ing. J. Horstmann, LanxessDeutschland GmbH 315

Future Plastic Applications

- Innovative plastic applications for a small urban bus concept**
G. Kopp, O. Deiβer, DLR Institut fūr Fahrzeugkonzepte, Stuttgart;
A. Mūller, S. Beyer, Hochschule Esslingen 317
- Innovative lightweight design for light-duty commercial vehicles: the GRP leaf spring**
Dr.-Ing. J. Stimpfl, Dr.-Ing. J. Asbeck, Mubea Fahrwerksfedern GmbH, Attendorn 319

Technology

- Industry-driven initiative to standardize continuous-fiber-reinforced thermoplastics for use in the automotive industry**
Dr.-Ing. S. Schmeer, Dr.-Ing. D. Scheliga, Institut fūr Verbundwerkstoffe GmbH, Kaiserslautern 321

Sponsor of gold:



Sponsor of bronze:

