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Munich, February 14, 2023
Abstracts Day 1

in-adhesives
Symposium on Innovations in
Adhesives and their Applications

February 9, 2023

nolax AG
Dr. Raphael Schaller

RELIABLE BOND ON SNOW – STRONG INTERLAMINAR ADHESION IN SKIS

Abstract
With the metamorphosis from transportation to sporting equipment, skis have experienced remarkable development over the last 100 years from a materials science perspective. Simple, bulky wooden slats emerged as modern high-performance laminates. The latter comprises different, affiliated materials that ensure driving comfort, performance, and less weight. Moreover, skis should be robust against humidity and temperature fluctuations and have a long service life.

Recently, nolax has explored interlaminar adhesion in skis. A significant challenge for ski manufacturers is joining dissimilar materials with different polarities and thermal expansion coefficients. Moreover, skis are exposed to extensive humidity and temperature changes, which often leads to delamination between the components, especially aluminum and epoxy.

To keep the design and shape and thus the riding comfort of skis, a technique established and used in the automotive industry can improve the adhesion between aluminum and epoxy. Metal sheets are coated first with a thermoplastic high-performance adhesive film before the polymer is rear-injected for manufacturing metal-polymer hybrid components for car interiors. Decrypted to skis, the aluminum top, and bottom chords can be coated first with an adhesive film at elevated temperature and under pressure in a flatbed laminator before further processing in the standard ski manufacturing process. Adhesive films replace labor and time-intensive pre-treatments of the metal surface, such as structuring, roughening, treating with primers, or a combination of these.

With a specific example from the ski industry, we want to show the impact on interlaminar adhesion when high-performance multi-layer adhesive films are used in the ski manufacturing process. Our adhesive film, based on a TPU/PE multi-layer, significantly reduces the failure rate of skis due to good wettability and absorption of stresses caused by different thermal expansion coefficients of the components.

University of Braunschweig / Institute of Joining and Welding
Tobias Hilse

RAPID BONDING OF WOODEN MODULES FOR CEILING CONSTRUCTIONS

Abstract
Remodelling and renovating of wooden beam ceilings can become a time consuming and complicated matter: transporting wooden beams longer than the room length through staircases and building up the floor/ceiling layer by layer will be avoided due a novel module-based concept for wooden ceiling constructions. These modules are self-supporting and will be mounted in a staggered pattern utilizing rapid adhesive bondings. First experimental results demonstrated the functionality of this novel technique on small scaled modules and will now be transferred to a bigger, more application-related module size.

SME (Subject Matter Expert) Optical Bonding

Dr. Belinda Berns

OPTICAL BONDING - A WHOLE NEW INDUSTRY – PART 2: CHALLENGES & DEFECTS

Abstract

This speech will be the second part of my new optical bonding presentation series that has started at In-Adhesives conference in May 2022, following up on my very first contribution to MKVS conference back in 2013. Last year you received an overview about optical bonding technology with part one: Optical Bonding - A Whole New Industry - Complex and Highly Demanding. This time I will provide to you some deeper insight into bonding process challenges and possible defects that can occur in this optical highly demanding industry.

Optical Bonding starts already with the right selection of components to be bonded. Besides perfectly clean surfaces of the components itself, also a clean working environment is needed to avoid any particle inclusion. Then, a good knowledge of the selected chemistry is recommended. This is one of the reasons that some do-it-yourself repairs of mobile phones for example at the end are not satisfying in optical appearance. With part one you gained some basic knowledge and saw an overview of this industry sector. Now you will dive deeper into the details. The different chemistries varying in process inherit some specific aspects to pay attention on during the bonding itself.

Interested in more details of this most invisible technology? Come and visit my speech at In-Adhesives conference in Munich February 14-15, 2023.

Avantium Renewable Polymers

Tom Claessen

BIO-REFINERY DERIVED FURANIC HUMINS AS BASIS FOR SUSTAINABLE THERMOSETS AND ADHESIVES

Abstract

Furanic humins are by-products obtained from carbohydrate valorization processes. Given the large amount of the carbon input that they can contain, they need to be considered as potential new bio based feedstock. In addition, all these product streams, when marketed at their highest value, deliver an economically viable technology for sustainable biochemicals production [1]. However, only limited valorization options are available; in fact, these materials are nowadays often simply considered as waste and mainly burnt as fuel for their heating value.

Furanic humins, are formed during acid-catalyzed (hydro)thermal conversion of the carbohydrate fractions of biomass, e.g. for the production of furfural and levulinate derivatives. At Avantium, they are a side product of the YXY® process. The YXY® technology catalytically converts plant-based sugar (fructose) into FDCA, the key building block for a wide range of plant-based chemicals and plastics such as polyethylene furanoate (PEF). The furanic humins are by-products of YXY® process currently producing FDCA at the pilot plant in Geleen (NL) and larger quantities are expected from the FDCA Flagship Plant in 2024 in Delfzijl (NL).

Humins are heterogeneous and polydisperse macromolecules, mainly constituted by furanic rings and aldehydes, ketones and hydroxyls as main functional groups. For many years, scientists focused on finding a way to avoid humins formation during biorefinery processes but that appears to be almost inevitable. The attention is now shifting towards ways to make high value-added products from humins to further improve the process economics of biorefineries.
An extensive analysis of the structure and pysico-chemical properties of humins was performed to demonstrate that it is possible to obtain a thermoset polymer with different properties based on the treatment used.

With the upscaling of the YXY® process, furanic humins as a new bio based side-stream, will become available in large volumes. Having the potential to form thermoset polymers furanic humins are a valuable feedstock for the adhesives market.

[1] de Jong, E., Gosselink R.J.A. (2014) Lignocellulose-based chemical products. In: “Bioenergy Research: Advances and Applications” (eds. Gupta, V.K., et. al.) Elsevier, Amsterdam, The Netherlands. pp. 277-313. ISBN: 978-0-444-59561-4.

Cardolite Specialty Chemicals Europe

Tom Berckmans

CASHEW NUTSHELL LIQUID-BASED EPOXY RESINS: RENEWABLE OPTIONS FOR EPOXY ADHESIVES AND SEALANTS

Abstract

Cashew NutShell Liquid (CNSL) is a non-food chain bio-based feedstock found in the honeycomb structure of the cashew (Anacardium Occidentale) nutshell. CNSL technology has offered versatile chemistries for developing specialty chemicals including epoxy resins and curing agents, and polyols and diols, which provides high bio-content, excellent hydrophobicity, adhesion strength, and improved thermal and mechanical properties in epoxy and polyurethane chemistry.

In this paper, novel CNSL epoxies were investigated as a partial and full substitute for BPA based epoxies in 1K and 2K epoxy formulations. CNSL epoxy resins have shown balanced performances in strengths and flexibility, excellent bonds on metals, and high water resistance properties. Utility of these CNSL bio-based epoxies includes high bio-content structural adhesives and sealants formulations, excellent durability and adhesion, and favorable labeling.

Kaneka Belgium

Nick Dewingaerden

MS POLYMER FOR HIGH STRENGTH / HIGH ELONGATION ADHESIVES

Abstract

Through the years Kaneka has developed several types of silane terminated polyethers (known to the market as Kaneka MS Polymer™). A special and exclusive group within this polymer range are the acryl modified MS Polymer™, a blend of silyl modified polyacrylates and silane terminated polyethers.

The combination of polymers with a different chain composition and structure allows strict control on morphology, compatibility and even glass transition temperature (Tg). It results in polymers with unique properties like adhesion to plastics and dissimilar materials, combined with a high-strength level adhesion. An overview of the latest developed acryl modified polymers will be shown, together with their unique properties. With this technology a continuous progress is achieved both in polymer design and practical applications.

A range of specific case studies will be presented (e.g. High Strength adhesives, combination of High Strength / High Elongation for more demanding applications, …).
The continuous development of these new polymer grades shows that Kaneka MS Polymer™ remains a key technology for the future and provides solutions for changing applications.

Dymax

Dr. Therese Hemery

UV TECHNOLOGY FOR PRECISION BONDING AND OPTICAL ASSEMBLY IN AUTOMOTIVE APPLICATIONS

Abstract

For many applications in automotive assembly processes, precision bonding plays a critical role. Complex optical systems like ADAS (Advanced Driver Assistance System), camera modules, sensors or adaptive front light systems have to be exactly positioned with the highest possible accuracy to ensure reliable functioning for safe driving.

This is accomplished through an Active Alignment process utilizing real-time measurements alongside light curable adhesives to fix the components in-place once positioned. While curing upon exposure to UV Broadband or LED light, the adhesive is critical towards maintaining alignment, bonding structural components, and fixing sensors, lenses or modules to the holder, barrel or PCB substrates. If necessary, a secondary heat or moisture curing step can address shadow areas. Active alignment adhesives must conform to strict technical requirements: minimal volumetric shrinkage, low CTE, rapid cure, and high Tg. Innovative Dymax UV-curable adhesives deliver on these requirements and allow for the assemblies to

perform at a more demanding level as well as driving the assembly process efficiencies to significantly increase capacity and productivity whilst reduce production costs by possibly up to 30 %.

This presentation is about developing and selecting the best suitable adhesive (regarding physical and mechanical properties) for the targeted applications and optimizing the (curing) process.

Bostik

Peter Kraushofer & Jean-Francois Chartrel


CYANOACRYLATE ADHESIVES - OPENING NEW PERSPECTIVES IN ASSEMBLY WITH "INSTANT ADHESIVES PRECISION DISPENSING"

Abstract:
For the bonding of parts with potentially small and complex geometries, the precision dispensing of the adhesive is essential to meet the bonding and sealing specifications and to respect aesthetics.

For productivity reasons, but above all of quality, the dispensing of the adhesive and the assembly of the glued parts are robotized. The desired productivity and the complexity of the parts most often require the dispensing of the adhesive with a variable flow rate at all points, which requires a volumetric system. The current volumetric systems are based on different technologies: piston pumps, gear pumps, peristaltic pumps or even by **progressive cavity pumps**, subject of this publication.

The problem becomes difficult when it comes to **cyanoacrylates** reacting extremely quickly in the absence of gap. In the specific case of progressive cavity pumps, the polymerization of the adhesive between rotor and stator causes at least a very audible "creak, in the worst case, destruction of the stator.

To solve the problem of rapid polymerization of cyanoacrylates in such volumetric dosing systems we have imagined a permanent **oscillation movement of the rotor between two dispensing sequences**. The computing management of the rotor allows also the dispensing of beads of different widths on the same part, and the production of bead of controlled geometry from the beginning (to avoid overflow at start-up) to the end in particular with the possibility of "suction- back". This controlled management allows the dispensing of a closed bead (Loop) without visible junction. The knowledge acquired in monocomponent Cyanoacrylates can be transposed to the bicomponent systems. **"High viscosity" and a fortiori "Gel" grades are more suitable for precision dispensing, such as the dispensing of beads not exceeding 0.3 mm in width.**

ViscoTec, one of the leaders with this type of dosing system, in mono and bi-component, has supported this development with its valuable advices and unshakable support. The work of selecting the best grade of elastomer was an important point of the project with the oscillation concept, one does not go without the other.

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medmix Switzerland AG

Tobias Bodenmüller

SUSTAINABILITY IN THE DIGITAL DEVELOPMENT PROCESS

Abstract
Over the last decades, the application of 2K-adhesives has been on the rise across various industries. With emergence of increasing use of plastics and disposal challenges, the quest for more effective material and reliable dispensing systems continues. Along the process chain, the assessment of environmental impacts will be a crucial element in successful application of 2K-adhesives and performance indicators in the future. As a leading manufacturer of 2K-component mixing and application systems, medmix already uses different simulation methods in the product development. We have now supplemented these with eco design principles to enable the best solution for our customers.

The article will cover what are medmix's sustainability goals in response to the changing framework conditions and how they are integrated into our development process. Beside several simulation technologies (injection molding, structural and fluid flow) we have now implemented life cycle analysis to calculate the ecological footprint of our products. Examples for a functional packaging which includes the interaction of different aspects will be in introduced and discussed.

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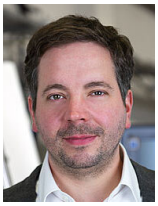
fitech ag
Patrick Thoma

PROCESS COMPARISON OF VISCOUS ADHESIVE AND SEALANT PRODUCTION

Abstract:
The production of adhesives is characterised by high attention to process quality, variability, production speed, cleaning time, energy consumption, environmental impact and safety.
These requirements must be implemented in production at different operational levels: manual, semi-automatical or fully automatical.
A process comparison shows possibilities for the current configuration and alternatives in the equipment mix.

University of Braunschweig / Institute of Joining and Welding
Hinrich Grefe



STRUCTURAL MONITORING OF ADHESIVELY STRENGTHENED STEEL STRUCTURES WITH DISTRIBUTED FIBREOPTIC SENSORS

Abstract
Adhesively bonded steel patches are used to repair and strengthen bridges or other engineering structures. With the additional layers of adhesive and steel upon the original structure, monitoring becomes rather difficult. Distributed fibreoptic sensors can provide a detailed look inside those layers and measure the local deformation; from that, the current condition of the structure and the bondline can be determined.

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as adhesive solutions e.K.
Marco Rodriguez

THE DIGITAL MONITORING OF BONDING PROCESS PARAMETERS

Abstract
Adhesive processes are becoming more and more complex, which means that the probability of failure will also increase in the near future. However, since adhesive bonding is a joining method that is becoming increasingly popular, it is becoming more important to keep the processes under control.

However, this can only be achieved if process data is recorded and evaluated. Data such as temperature and humidity can influence bonding processes and should be constantly monitored in order to be able to react in case of deviations.

The digital recording and evaluation of such parameters is an important step in the right direction. Regardless of whether manual or automated processes are used, the issue of traceability is a focus topic. The current situation of manual documentation is no longer up to date and must be discontinued. APP and cloud-based systems can help here.

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM
Ivo Neumann

ADHESIVE BONDING 4.0: IMPLEMENTATION OF UNIFIES COMMUNICATION STANDARD IN THE ADHESIVE BONDING PRODUCTION

Abstract
Successfully digitised adhesive bonding technology is not only based on the necessary use of sensors, cameras, controllers and computers, but also requires the standardisation of the associated data communication. In the publicly funded project "Adhesive Bonding 4.0", this standardisation is being developed for the field of adhesive bonding technology with the participation of the industry for commercially available adhesive application systems.
