Conference Program at a glance

Day 1 Thursday, May 12, 2022

in-adhesives
Symposium on Innovations in Adhesives and their Applications

09:00 - 09:25

nolax

Dr. Raphael Schaller

STORAGE-STABLE, FIBER-REINFORCED ADHESIVE FILMS FOR ULTRA-HIGH-PERFORMANCE SAILS - ENDURANCE TEST FROM LE HAVRE TO SALVADOR DE BAHIA

Abstract

nolax's latest technology of fiber-reinforced adhesive films will set new benchmarks in the composite field. These new films are impressive due to their simple processing into composite parts with ultra-high performance regarding stiffness, tensile strength, toughness, and remarkably low weight. This unique system results from a spiffy combination of different technologies: unidirectionally embedded high-performance fibers, special processing, and innovative adhesives.

Binders used to produce conventional unidirectional fiber-reinforced adhesive films typically contain solvents and have a relatively short pot life since a two-component system is often used. As a prepreg, such reactive systems must be stored at low temperatures to avoid crosslinking and thaw before further processing. nolax developed a new way to increase workplace safety and streamlining production by using only water-based, solvent-free adhesives to impregnate spread fibers. Furthermore, nolax uses latent-reactive adhesive systems, in which the cross-linker is encapsulated, offering a larger processing and storage window. After careful drying, even with a cross-linker present, these fiber-reinforced adhesive films can be stored at room temperature for an extended period (typically 12 months). With this technique, nolax has developed storage-stable, uniaxially fiber-reinforced adhesive films that combine toughness and high tensile strength (up to 1 GPa in tensile strength) with low weight (as low as 15 g/m^2) and outstanding flexibility and temperature resistance. Typical application areas of our fiber-reinforced adhesive films are, among other things, tension components in industrial belts, reinforcements in skis, and sail membranes.

With a specific example from the off-shore racing endurance test from Le Havre to Salvador de Bahia, we want to show how fiber-reinforced adhesive films are made and used for manufacturing ultra-high-performance sails. Moreover, we want to show which circumstances lead to the development of highly flexible, latent-reactive matrix systems for fiber-reinforced adhesive films.

09:25 - 09:50

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

Jonas Wirries

PROPERTIES AND SHRINKAGE BEHAVIOUR OF CURING STRUCTURAL ADHESIVES

Abstract

During the process of adhesive curing, volume shrinkage occurs due to the cross-linking of the polymer chains. In interaction with the adhesion between components and adhesive and the change of properties, such as the increase in Young's modulus and the decreasing relaxation capacity, the curing shrinkage leads to formation of residual stresses in bonded joints. The prediction of these residual stresses has so far been limited to application-specific models and cannot be used generally. To enable a more global prediction, better knowledge of the relaxation behaviour is needed.

Based upon experimental results of the thermoanalytical characterisation of structural adhesives during cure, input data for FEA are generated. In addition, the effects of shrinkage and residual stresses on simple geometries are determined during adhesive curing. Furthermore, a method is developed to determine curing shrinkage under different stiffnesses of the joining partners. These findings will be combined to extend existing mechanical models to include relaxation behaviour and improve predictions of residual stresses.

09:50 - 10:15

Fracture Analytics

Dr. Martin Brandtner-Hafner

STRUCTURAL SAFETY EVALUATION OF ADHESIVE SEALANTS

Abstract

In the construction industry, adhesives and liquid sealants have become indispensable. The harsh conditions on-site often demand the highest performance from such products. Since adhesive applications and sealing solutions are often required in one product, so-called adhesive sealants are tailored hybrid solutions. The aim here is to combine the best of two worlds. However, information from the manufacturers' technical datasheets only provides a first rough overview of their lab performance. Likewise, missing key figures and a lack of empirical data often lead to confusion among practitioners and even end in faulty applications. The resulting damage often leads to financial if not legal problems. To avoid these, commercially available adhesive sealants were tested for their structural bonding suitability and compared with benchmarks from the industry. It was found that one chemical system is particularly highly suitable for both, bonding and sealing building materials, respectively. This gives the user the opportunity to select and optimally apply the ideal adhesive sealing system for his application.

Keywords:

Structural Safety Evaluation, Bonding Efficiency, Adhesive Sealants, Safety Zone, Sealant & Adhesive Factor.

10:15 - 10:45 REFRESHMENT BREAK

10:45 - 11:10

Huntsman Advanced Materials

Simon Thering

INTRODUCING ARALDITE® ADHESIVE MATERIAL MODELS - ACHIEVE ACCURATE APPLICATION SIMULATIONS LEADING TO A SHORTER QUALIFICATION TIME OF ADHESIVE INNOVATIONS

Abstract

While numerical simulation is widely recognized as a robust tool to assist design of adhesively bonded structures, its applicability relies on realistic data combined in a material model based on solid experimental characterization. Huntsman just recently launched its new realistic adhesive material models that help adhesive users to achieve fast and accurate application simulations when qualifying adhesives. Based on solid experimental characterization, the adhesive material models provide a wealth of information about the physical, mechanical and thermal behaviour of the Huntsman adhesive core product range. The adhesive material model helps adhesive users to go to market faster and shorten qualification time by getting the data they need to predict the combined effect of design parameters and adhesive properties over the process and operational conditions of the customer`s project.

This presentation is about presenting the new material model, showing how a simulation can help to shorten the qualification time by defining the fitting adhesive fast. A case study about the latest launched ARALDITE® 2080 two-component acrylic adhesive, will highlight how important a simulation is to qualify especially new innovative adhesives faster. ARALDITE® 2080 adhesive solves customer`s issues that are related to currently used MMA or PU adhesives while being low odor, non-flammable, primer free and having good EHS values. Despite those, ARALDITE® 2080 adhesive provides high bond strength, elongation, flowability, and fast cure times.

11:10 - 11:35

Coatex (Arkema Group)

Dr. Catherine CORFIAS-ZUCCALLI

RHEOLOGICAL CHARACTERIZATION OF WATER-BASED TILE ADHESIVES

Abstract

How to ensure that a thick adhesive is easy to apply and holds up when bonding the substrates? What does it take for a correct adhesive application? The answer lies in optimizing rheological properties of systems to achieve the thickness and workability

together with control of sag, hold up and creep of the wet adhesive. Control of its application is essential to ensure its final mechanical and adhesion properties.

The applicability of waterborne adhesives using a manual tool is very dependent on the ability of the adhesive to flow under stress. Thus, the rheological approach is relevant to physically describe the flow mode of these soft solid viscoelastic materials that need to be applied with a high, regular and homogeneous thickness on different substrates.

The objective is to identify the rheological parameters that best describe the applicability of these thick adhesives. We will compare various acrylic thickeners to illustrate these parameters.

These characterizations will be carried out in formulations comprising the essential ingredients to target the mechanical resistance of these thick adhesives, aiming at achieving correlations between viscoelastic behavior and application properties.

11:35 - 12:00

fitech

Patrik Thoma

AUTOMATION OF MIXING PROCESSES FOR ADHESIVES AND SEALANTS

Abstract

Profitability, on time delivery and flexibility are three important goals in the production of sealants and adhesives. These three goals of a production are opposed to each other, the demands for on time delivery and flexibility are opposed to the demand for profitability. Is it possible to improve different demands of a production at the same time by using process automation and clever mixing technology? If so, what degree of process automation does make sense?

Depending on product variety and manufacturing quantities, either manual or automated production is most suitable. However, process automation is not only required to reduce man costs. Reliable raw material and product handling increases reproducibility and manufacturing quality. At the same time, the environmental footprint of energy consumption, emissions and waste is reduced. Processes are stabilized and employee satisfaction is increased. When choosing the appropriate mixing technology, finished product quality as well as flexibility and profitability are crucial. Using practical examples, we present possibilities of process automation and mixing technology that can influence the innovation and development of adhesives.

12:00 - 13:30 LUNCH

13:30 - 13:55

Cardolite Corporation

Tom Berckmans

NOVEL CYCLOALIPHATIC CASHEW NUT SHELL LIQUID BASED ISOCYANATE BLOCKING AGENT FOR LOWER DEBLOCKING TEMPERATURE

Abstract:

Cashew Nut Shell Liquid (CNSL) is a non-edible natural oil obtained as a by-product of the Cashew nut industry. CNSL is used as building block for materials used in epoxy coatings, adhesives, composites and PU Foam. Its unique chemical backbone improves chemical resistance, hydrophobicity, and thermal properties.

NX-2026™(3-pentadeca-dienyl-phenol) is a very high purity cardanol, derived from Cashew Nutshell Liquid. Once used in polyurethane prepolymers as an isocyanate blocking agent, it has demonstrated favorable and easily tunable deblocking conditions. Cardolite has already introduced tools i.e. catalysts, deblocking agents, to optimize and lower deblocking temperature of NX-2026 blocked isocyanates in a previous presentation.

In this paper, a novel cardanol-based fully cycloaliphatic derivative, called CNSL-Oxime, will be presented, investigating its use as innovative isocyanate protective group with faster reactivity and lower deblocking temperatures than petro-derived benchmarks, without compromising shelf-life of blocked systems nor affecting mechanical and thermal properties of epoxy-PU hybrid systems.

13:55 – 14:20

ARKEMA

Orlane Bouzard

IMPROVE SUSTAINABILITY & PERFORMANCE WITH POLYAMIDE RHEOLOGY WAXES

Abstract:

Rheology modifiers are key ingredients to reach the ever more demanding performance standards of many adhesives and sealants systems including ease of application combined with structure development. Such additives are helping adhesives & sealants manufacturers in meeting existing and future challenges in many areas. For example, the construction market is requiring higher load-bearing capacity with the rise of high tack systems. The importance of bio-based raw materials is not to be undermined either in today's world. This is why polyamide-based rheology modifiers are not only high-performance additives but also stand for sustainable additive solutions.

Polyamide rheology modifiers are established as leading additives for enhanced applicative control in Silylated Terminated Polymer (STP), compared to other technologies such as fumed silicas or precipitated calcium carbonates. Other reactive technologies can also benefit from their better structure control, for example: 2K-Epoxies, 2K-PU, acrylates.

After introducing the Polyamide Rheology Modifiers technology, their benefits in each relevant system will be described. This presentation will highlight the innovation in STP systems, adapting to the current challenges: shortening cycle times, enhancing tack. It will then demonstrate how such additives can be interesting in other reactive systems focusing on rheological behavior using different characterization methods. Finally, an overview of the sustainability aspect of these additives will be presented.

14:20 – 14:45

Jowat

Dr. Hartmut Henneken

TRANSFORMATION TO A CIRCULAR ECONOMY: CHALLENGES AND APPROACHES FOR ADHESIVE MANUFACTURERS

Abstract:

The chemical industry is facing a huge structural change. Enormous efforts are needed to achieve the goal of fully sustainable production of raw materials and chemical products. Decarbonising the energy supply is one approach to significantly reduce the carbon footprint. However, this approach does not work for chemical products, as carbon is absolutely necessary as the molecular backbone of our products. Here, a path towards a circular economy must be taken in order to use as little new fossil carbon as possible (ideally, in the end, none at all). Approaches to this are the use of renewable or recyclate-based raw materials for certain products and/or an allocation of sustainable raw materials via the mass balance method. This presentation will give an overview, present the status quo from an adhesive manufacturer's point of view and show where the journey for a better sustainable future could (or should) lead.

14:45 – 15:15

PANEL DISCUSSION

University of Kaiserslautern, Workgroup Materials and Surface Technologies

Univ.-Prof. Dr.-Ing. Paul Ludwig Geiß

HOW MUCH CIRCULAR IS THE GREEN TRACK TO NET ZERO?

15:15 - 15:45 REFRESHMENT BREAK

15:45 – 16:10
INNOVENT
Dr. Andreas Pfuch

APPLICATION OF DIFFERENT PHYSICAL PRE-TREATMENTS FOR IMPROVED BONDING OF CARBON-FIBRE REINFORCED POLYMERS

Abstract:
With view on urgent subjects such as climate change and energy policy, the importance of fibre-reinforced plastics will certainly increase in the next years. In the fields of construction and especially joining of fibre-reinforced plastics, there is currently no way out of adhesive technologies. Pre-treatment methods like the use of suitable chemicals, a mechanical roughening procedure or the use of peel ply are required for correspondingly stable bonds. So, the use of chemicals, most of which are hazardous to the environment, seems to be problematic in the future. The latter two processes in particular can damage the fibre-matrix structure. Following, alternative dry gas-phase-based pre-treatment methods such as the use of atmospheric plasmas or the use of various flame treatment techniques are promising alternatives. However, an overview of the efficiency of different pre-treatment methods in the field of bonding carbon fibre-reinforced plastics (CFRPs) has been rather difficult to find so far.

This contribution takes a closer look at the influence of different atmospheric plasmas and flames on the surface conditions of CFRP and on the given potential for increasing the bond strength of CFRP bondings.

16:10 – 16:35
Plasmatreat
Klaus Kresser

PLASMAPLUS® - THE NEW TECHNOLOGY FOR SOLVENT FREE BONDING

Abstract
Why is it beneficial to dispense with solvents? Solvents are only auxiliary materials for processing coatings or adhesives. This means that for the actual function - such as adhesion, corrosion protection, etc. - they make no contribution. On the contrary, they make production processes more expensive, since useless material has to be transported, stored and processed. In addition, solvents often lead to tighter labeling of coatings or adhesives because they become harmful to health, hazardous to the environment or flammable.

Here, PlasmaPlus® coating simplifies the process. All different types of materials like plastic, glass, metal, aluminum, etc. can be coated with PlasmaPlus®. Plasma polymerization with the PlasmaPlus® process is already being used successfully for surface coating in a large number of different industrial applications. Herewith PT-Bond coatings assure long-term adhesion.

In the paper, the following topics will be introduced and discussed:

- Distinction between different plasma technologies: Activation of surfaces and coating of surfaces via PECVD (Plasma Enhanced Chemical Vapor Deposition.
- Examples of substrate/adhesive combinations, where PECVD can be used for the replacement of primers.
- State of the Art solutions for solvent and flash-off free bonding processes and their technical and chemical background.
- Examples of successful implementation and industrialization of green processes and new materials with PECVD technoly
- Examples Lean pre-treatment solutions for bonding are industrialized

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16:35 – 17:00
Technical University of Braunschweig / Institute of Joining and Welding
Elisabeth Stammen

THE TRAIN HAS NOT YET LEFT THE STATION - NEW ADHESIVE BONDING TECHNIQUES FOR STRENGTHENING REFURBISHED STEEL CONSTRUCTIONS

Abstract
Steel bridges with orthotropic roadway decks are a common construction method for long-span bridges. The construction method was developed in the 1960s and especially the early structures

show increasing crack damage. On the one hand due to construction errors, on the other hand due to massively increased traffic loads. The development of innovative techniques for the repair and reinforcement of such bridges is currently the most important challenge. These techniques should ensure not only the load bearing capacity but also the fatigue resistance and durability of the structure for the future, preferably over the lifetime of the entire bridge structure.

This requires low-cost and effective reinforcement concepts. Previous maintenance methods, such as repair welds, the drilling out of crack tips or the screwing on of pre-stressed steel plates, often have limitations in terms of fatigue strength, feasibility or traffic disruption. Since the traffic volume is not reduced, local crack repair usually only prolongs the service life for a short time and results in renewed crack growth.

Due to the high costs and the fact that in many cases new buildings cannot be constructed without problems, in most cases only a repair and upgrading of the structures is expedient. The need for renovation methods and procedures that extend the life of the structure even further is high. Here, rehabilitation methods with bonded steel patches using structural, cold-curing epoxy resin or polyurethane adhesives seem to be a method of choice, for which solutions are being developed in a German research project.

Results on adhesive selection and mechanical properties as well as on surface treatment with regard to the manufacturing process are presented here. Influences in the bonding process on a construction site as well as measures for fast construction progress are considered.

The research has not yet been completed, and a follow-up project is already close to being funded. However, it can already be said that it was possible to significantly increase the service life in relation to the notch cases investigated and to create a pre-dimensioning concept developed through numerical and analytical calculations.

18:30 NETWORKING DINNER