

Structuring and preparation of a lesson: EAE module 2 (Materials as adherends)

time	Theme, core information, statements or questions	Learning objectives ¹	Methods (e.g. presentation/ discussion/group work)	Media/ training material
16 h	<p><u>Important Adherend Properties:</u></p> <p>Bulk structure of different materials (metals, plastics, composites, wood and glass) with the focus on mechanical properties (modulus, strength, ductility) and chemical resistance</p> <p>Cross section of different materials (metals, plastics, composites and glass) with the focus on surface energy and wettability, chemical resistance and ability to generate adhesion forces</p>	<p>To be able to name and explain the requirements of substrate surfaces for effective bonding and the objectives of surface treatment.(2)</p> <p>To be able to describe the fundamental structure of metals and their bonding-related properties. (1)</p> <p>To be able to describe the bonding-related properties of low-alloy, high-alloy, and galvanized steel and also aluminum. (1)</p> <p>To be able to describe the fundamental structure of plastics and their bonding-related properties. (1)</p> <p>To be able to explain the bonding properties of</p>	<p>Question about materials used in the work shop</p> <p>Discussion about daily experiences and procedure in the practical course exercises</p> <p>Development of content with the participants</p> <p>Practical demonstration (e.g. mechanical behavior of steel, different types of plastics, glass and composites, wetting tests with low and high surface energy materials)</p>	<p>Demonstration objects (e.g. tin coated steel bar, composite with peel ply, different types of reinforcement fibers and semi-finished fiber products, different types of plastics, glass, test inks)</p> <p>White board</p> <p>Handouts</p> <p>Text book</p>

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		<p>different plastics using terms such as polarity, reactivity, chain mobility, and additives. (2)</p> <p>To be able to describe the fundamental structure of float glass and its bonding-related properties. (1)</p> <p>To be able to explain why a gel layer forms on float glass and the relevance of this for adhesive bonding. (2)</p> <p>To be able to describe the fundamental structure of fiber reinforced plastics (fibers, matrix systems, laminate structure, peel-ply) and their bonding-related properties. (1)</p>		
3 h	<p><u>Surface preparation:</u></p> <p>Objectives and other requirements of a surface (reflection/repetition of following terms: wetting, surface energy, forces)</p> <p>Classification of methods (surface</p>	<p>To be able to explain, in relation to surface preparation, the meaning of acclimatization, visual inspection, and checking the accuracy of fit.(2)</p>	<p>Question about surface preparation methods in the work shop</p> <p>Discussion about</p>	<p>Demonstration objects (e.g. cleaning tissue, hand cream that contains silicone)</p> <p>Practical demonstration of environmental stress</p>

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	<p>preparation and pretreatment) and influencing factors on the choice of method(s)</p> <p>Several preparation methods with focus on the objectives/aims and the procedures: Acclimatization, visual inspection, checking the accuracy of fit</p> <p><u>Cleaning:</u></p> <p>Objectives (remove all contaminations)</p> <p>Reflection/repetition of following terms: wetting, surface energy, nanometer rule</p> <p>Procedures (cleaning methods like wiping, bath technique incl. ultrasonic bath, vapor degreasing, spraying or plasma)</p> <p>Types of cleaning agents (organic solvents (halogenated hydrocarbons, hydrocarbons, oxygen containing hydrocarbons and water based cleaning agents with different pH-values, compressed gases)</p> <p>Heading points related to cleaning procedure (e.g. correct wiping technique, bath renewal)</p> <p>Properties for an appropriate cleaning</p>	<p>To be able to name and explain different cleaning processes for surface pretreatment (metal and plastic surfaces) and the requirements on cleaning agents. (2)</p> <p>To be able to name the objective of cleaning substrate surfaces prior to bonding (2)</p> <p>To be able to name different contaminations (1)</p> <p>To be able to name and characterize different cleaning agents (2)</p> <p>To be able to name requirements on cleaning agents (1)</p> <p>To be able to name and explain different cleaning processes for metal, glass and plastic surfaces and the quality influencing</p>	<p>daily experiences and procedure in the practical course exercises</p> <p>Development of content with the participants</p> <p>Question about cleaning procedures in the work shop</p> <p>Discussion about daily experiences and procedure in the practical course exercises</p> <p>Presentation of content by ppt-presentation</p> <p>Practical demonstration (e.g. of correct wiping technique, ultrasonic bath)</p>	<p>cracking of PMMA</p> <p>Beamer/ printed ppt-presentation</p> <p>White board</p>
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	<p>agent (remove all contaminations, residue free evaporation especially for water based systems, no damage of substrates, occupational health and safety)</p> <p>Heeding points related to cleaning plastics: Environmental stress cracking</p> <p>Silicone problem (wetting problem, impossible to remove, consequences for the workshop, sources)</p>	<p>parameters (3)</p> <p>To be able to name and explain the phenomena of environmental stress cracking and external and internal influencing factors (2)</p> <p>To be able to explain why silicones are critical contaminations (3)</p> <p>To be able to name and explain organizational measures to prevent silicone contaminations (2)</p> <p>To be able to name potential silicone sources (1)</p>		
21 h	<p><u>Surface treatment:</u></p> <p>Objectives and other requirements of a surface (reflection/repetition of following terms: wetting, surface energy, forces)</p> <p>Classification of pretreatment methods and influencing factors on the choice of method(s)</p>	<p>To be able to name and explain the requirements of substrate surfaces for effective bonding and the objectives of surface treatment.(2)</p> <p>To be able to name and explain the different</p>	<p>Question about pretreatment methods in the work shop</p> <p>Discussion about daily experiences and procedure in the practical</p>	<p>Demonstration objects (e.g. substrate with peel ply, corundum as grit material, plasma treated substrates, test inks, primer bottle, application tools for primers)</p>

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	<p>Several preparation methods with focus on the objectives/aims and the procedures: Acclimatization, visual inspection, checking the accuracy of fit</p> <p>Cross-section of an injection molded plastic substrate and explanation of the injection molding skin and its wetting property.</p> <p>Several pretreatment methods with focus on their objectives/aims, the procedures and advantages/disadvantages: Mechanical (grinding / grit blasting) Chemical (etching) Physical (flame treatment, plasma treatment, VUV activation, laser treatment) Primers</p> <p>Different plasma methods (activation, coating, cleaning)</p> <p>Heeding points related to each method (e.g. mechanical treatment of different sorts of plastic, stability of activation effect, risk of over activation, effects of deviations from correct primer application)</p>	<p>layers of a cross-section of a plastic. (2)</p> <p>To be able to explain, in relation to surface preparation, the meaning of acclimatization, visual inspection, and checking the accuracy of fit.(2)</p> <p>To be able to name and explain different surface pretreatment methods including grinding, grit blasting, etching, flame treatment, plasma treatment, VUV treatment and laser treatment in respect of the physical and chemical principles, the technical characteristics of the methods, the changes to the surfaces, field of applications. (2)</p> <p>To be able to explain the function and the processing of a primer. (2)</p>	<p>course exercises</p> <p>Development of content with the participants</p> <p>Practical demonstration (e.g. peel ply, wetting tests with plasma treated substrates, plasma nozzle, primer processing)</p>	<p>White board</p> <p>Handouts</p> <p>Text book</p> <p>Videos</p>
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		To be able to name and explain selection criteria for surface treatment methods including advantages and disadvantages of the presented surface treatment methods (2)		
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