Structuring and preparation of a lesson: **EAS module 2 (Marerials as adherends)**

time	Theme, core information, statements or questions	Learning objectives [1]	Methods (e.g. presentation/ discussion/group work)	Media/ training material
6 h	<u>Important Adherend Properties:</u> Bulk structure of different materials (metals, plastics, composites and glass) with the focus on mechanical properties (modulus, strength, ductility) and chemical resistance 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	To be able to describe the fundamental structure of metals and their bonding-related properties. (1) To be able to describe the bonding-related properties of low-alloy, high-alloy, and galvanized steel and also aluminum. (1) To be able to describe the fundamental structure of plastics and their bonding-related properties. (1) To be able to explain the bonding properties of different plastics using terms such as polarity, reactivity, chain mobility, and additives. (2) To be able to describe the fundamental structure of	Question about materials used in the work shop Discussion about daily experiences and procedure in the practical course exercises Development of content with the participants Practical demonstration (e.g. mechanical behavior of steel, different types of plastics, glass and composites, wetting tests with low and high surface energy materials)	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) White board Handouts Text book

[1] (1) Know and understand, (2) transfer and practically apply, (3) analyze and assess; (0) no learning objective; additional information

		float glass and its bonding-related properties. (1) To be able to explain why a gel layer forms on float glass and the relevance of this for adhesive bonding. (2) 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)		
2 h	<u>Surface preparation:</u> Objectives and other requirements of a surface (reflection/repetition of following terms: wetting, surface energy, forces) Classification of methods (surface preparation and pretreatment) and influencing factors on the choice of method(s) Several preparation methods with focus on the objectives/aims and the procedures: Acclimatization, visual inspection, checking	To be able to name and explain the requirements of substrate surfaces for effective bonding and the objectives of surface treatment.(2) To be able to name and explain the different layers of a cross-section of metals and plastics. (2) To be able to explain, in relation to surface	Question about surface preparation methods in the work shop Discussion about daily experiences and procedure in the practical course exercises Development of content with the	Demonstration objects (e.g. cleaning tissue, hand cream that contains silicone) Practical demonstration of environmental stress cracking of PMMA White board Text book Handouts

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	the accuracy of fit and cleaning <u>Cleaning:</u> Objectives (remove all contaminations) Reflection/repetition of following terms: wetting, surface energy, nanometer rule Procedures (cleaning methods like wiping, bath technique, vapor degreasing or plasma) Types of cleaning agents (organic solvents (e.g. oxygen containing) and water based) Heeding points related to cleaning procedure (e.g. correct wiping technique, bath renewal) Properties for an appropriate cleaning agent (remove all contaminations, residue free evaporation especially for water based systems, no damage of substrates, occupational health and safety) Heeding points related to cleaning plastics: Environmental stress cracking Silicone problem (wetting problem, impossible to remove, consequences for	preparation, the meaning of acclimatization, visual inspection, and checking the accuracy of fit.(2) To be able to name the objective of cleaning substrate surfaces prior to bonding (2) To be able to name and explain different cleaning processes for surface pretreatment (metal and plastic surfaces) and the requirements on cleaning agents. (2) To be able to name the environmental stress crack phenomina (1) To be able to explain why silicones contaminations must be absolutely avoided for efficient adhesive bonding. (3) To be able to name possible sources of	participants Question about cleaning procedures in the work shop Discussion about daily experiences and procedure in the practical course exercises Development of content with the participants Practical demonstration (e.g. of correct wiping technique)	

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	the workshop, sources)	silicones. (1)		
6 h	<u>Surface pretreatment:</u> Several pretreatment methods with focus on the objectives/aims and the procedures: Mechanical (grinding / grit blasting) Physical (flame treatment, plasma treatment) Primers Heeding points related to each method (e.g. mechanical treatment of different sorts of plastic and metals, stability of activation effect, risk of over activation, effects of deviations from correct primer application)	To be able to name and explain different surface pretreatment methods including grinding, grit blasting, pickling, anodization, SACO, flame pyrolysis, flame treatment, and plasma treatment. (2) To be able to explain the function of a primer for surface post-treatment. (2)	Question about pretreatment methods in the work shop Discussion about daily experiences and procedure in the practical course exercises Development of content with the participants Practical demonstration (e.g. peel ply, wetting tests with plasma treated substrates, primer processing)	Demonstration objects (e.g. substrate with peel ply, corundum as grit material, plasma treated substrates, test inks, primer bottle, application tools for primers) White board Handouts Text book Videos

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