

Structuring and preparation of a lesson: EAE module 6 (Testing and analysis)

time	Theme, core information, statements or questions	Learning objectives ¹	Methods (e.g. presentation/ discussion/group work)	Media/ training material
4 h	<p><u>Property determination for adhesives, Adherend or Joints:</u></p> <p>Methods to measure the properties by preparing bulk specimens of the adhesive (e.g. static testing, dynamic testing, rheological characterization)</p> <p>Methods to measure the properties by using specially designed joint geometries to measure the failure strength and to analyse the fracture and failure behaviours</p>	<p>-explain in detail adherend or substrate properties (1);</p> <p>-define methods for determining adherend or substrate properties (1);</p> <p>-select all the adequate methods for measuring mechanical properties of the adhesive and substrate (2);</p> <p>- evaluate the adhesive or substrate property results(3);</p> <p>-monitor property determination for adhesive, adherend or joint;</p>	<p>Ppt content presentation</p> <p>Practical (group) exercise about adhesive and substrate properties measurement, including results evaluation. or Hands on /group discussion about the selection of adequate methods for properties measurements;</p> <p>Visit to the laboratory for observation of some properties determination;</p>	<p>Beamer / printed ppt presentation</p> <p>White board</p> <p>Text book</p> <p>Practical exercise</p>
8 h	<p><u>Characterisation of raw material and cured adhesive</u></p>	<p>- explain in detail raw materials and cured adhesives properties</p>	<p>Ppt content presentation</p>	<p>Beamer / printed ppt presentation</p>

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	<p>Determination of properties of Raw Material (e.g. Viscosity, reaction time for adequate adhesive, DSC, Infrared spectrometry, chemical determination of the composition of the adhesive)</p> <p>Determination of properties of Cured Adhesive (e.g. Mechanical characterization as other materials, DMA; Chemical, Thermal, Electrical and Optical properties)</p>	<p>(1);</p> <ul style="list-style-type: none"> - define methods for determining the properties of raw materials and cured adhesives (1); - select all adequate methods for determining the properties of raw materials and cured adhesives (2); -evaluate the raw materials and cured adhesives property results (3); - monitor property determination for raw materials and cured adhesives. 	<p>Practical (group) exercise about raw materials and cured adhesives properties measurement, including results evaluation.</p> <p>Hands on /group discussion about the selection of adequate methods for properties measurements;</p> <p>Visit to the laboratory for observation of some properties determination;</p>	<p>White board</p> <p>Text book</p> <p>Practical exercise</p>
4 h	<p>Destructive Testing (DT)</p> <p>National, EN or ISO Standards Industry Specifications and standards</p> <p>Destructive testing of the Assembly (e.g. Failure strength measurements; fracture testing and failure analysis; Thermal</p>	<p>-explain the use of standards and specifications from the industry for testing materials (e.g: adhesively bonded test pieces); (1)</p>	<p>Ppt content presentation</p> <p>Practical (group) exercise about inspection objectives and</p>	<p>Beamer / printed ppt presentation</p> <p>White board</p> <p>Text book</p>

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	<p>properties and temperature effects; fatigue testing and failure analysis)</p> <p>Tests for the durability of the Assembly (e.g. Thermal and Mechanical constraints, Moisture, Chemical environment, UV and combined effects);</p>	<p>-select the relevant destructive methods depending on the inspection objectives; (2)</p> <p>- discuss about destructive test objectives and limitations of the data generated;(2)</p> <p>-evaluate the data generated from the destructive testing (3);</p> <p>- monitor destructive testing methods applied to test pieces.</p> <p>- decide autonomously about DT methods according to specific inspection objectives.</p>	<p>selection of proper DT methods, including the evaluation of results;</p> <p>or</p> <p>Hands on/group brainstorming about DT field of application and limitations;</p> <p>Video presentation /demonstration (e.g: destructive testing)</p> <p>Visit to the laboratory (e.g: to observe some examples of DT methods);</p>	<p>Practical exercise</p> <p>Video</p>
10 h	<p><u>Non Destructive testing (NDT)</u></p> <p>National, EN or ISO Standards Industry Specifications and standards</p> <p>Fundamental of NDT methods (e.g. Visual inspection; liquid penetrant, Sonic vibration techniques; X-ray; thermal inspection methods, holography and Transmission</p>	<p>-explain standards and specifications from the industry for testing materials(1);</p> <p>- explain all types of non-destructive testing methods and industrial techniques (1);</p>	<p>Ppt content presentation</p> <p>Practical (group) exercise about inspection objectives and</p>	<p>Beamer / printed ppt presentation</p> <p>White board</p>

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	<p>and pulse-echo ultrasonics)</p> <p>Fields of application and limitations</p> <p>Design in respect to NDT</p> <p>Calibration</p>	<p>-select the relevant NDT methods depending on the inspection objectives (2);</p> <p>-discuss about the field of application of each type non -destructive test and the limitations of the data generated;(2)</p> <p>- evaluate the adhesive pieces design attending to the subsequent tasks and work order, to guarantee the accessibility for NDT(3);</p> <p>- identify calibration references to be used in NDT methods and techniques (e.g: UTprobcapcalibration); (1)</p> <p>- monitor non-destructive testing methods applied to adhesive fabrications;</p> <p>- decide autonomously about NDT methods</p>	<p>selection of proper NDT methods, including the evaluation of results;</p> <p>Hands on /group brainstorming about NDT field of application and limitations;</p> <p>Practical demonstration (e.g. of correct adhesive pieces design)</p> <p>Video presentation /demonstration (e.g: non destructive testing)</p> <p>Visit to the laboratory (e.g: to observe some examples of NDT methods)</p>	<p>Text book</p> <p>Demonstration objects (e.g: adhesively bonded pieces)</p> <p>Practical exercise</p> <p>Video</p>
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		according to specific inspection objectives.		
4 h	<u>Examination of Joint Fracture Surfaces and Adhesive Layer</u> Failure analysis Test Methods used in failure analysis	-explain in detail the mechanisms and properties of the different kinds of fractures affecting adhesives layer (1); -evaluate failures and fractures in adhesives joints (3) -select the relevant test methods for detecting failure analysis (2) -Monitor testing methods for failure analyses applied to adhesives joints. - Decide autonomously about test methods for detecting failure analyses	Ppt content presentation Practical (group) exercise about the selection of proper failure analyses methods Practical demonstration (e.g. analyses of adhesive pieces design) Video presentation /demonstration (e.g: failure analyses methods) Visit to the laboratory (e.g: to observe some examples of failure analyses methods)	Beamer / printed ppt presentation White board Text book Demonstration objects (e.g: adhesively bonded pieces) Practical exercise Video

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