



Automotive needs & CRF/DJ-LAB@PoliTO collaborations

2021/05/04

Performanc

Reliabilit

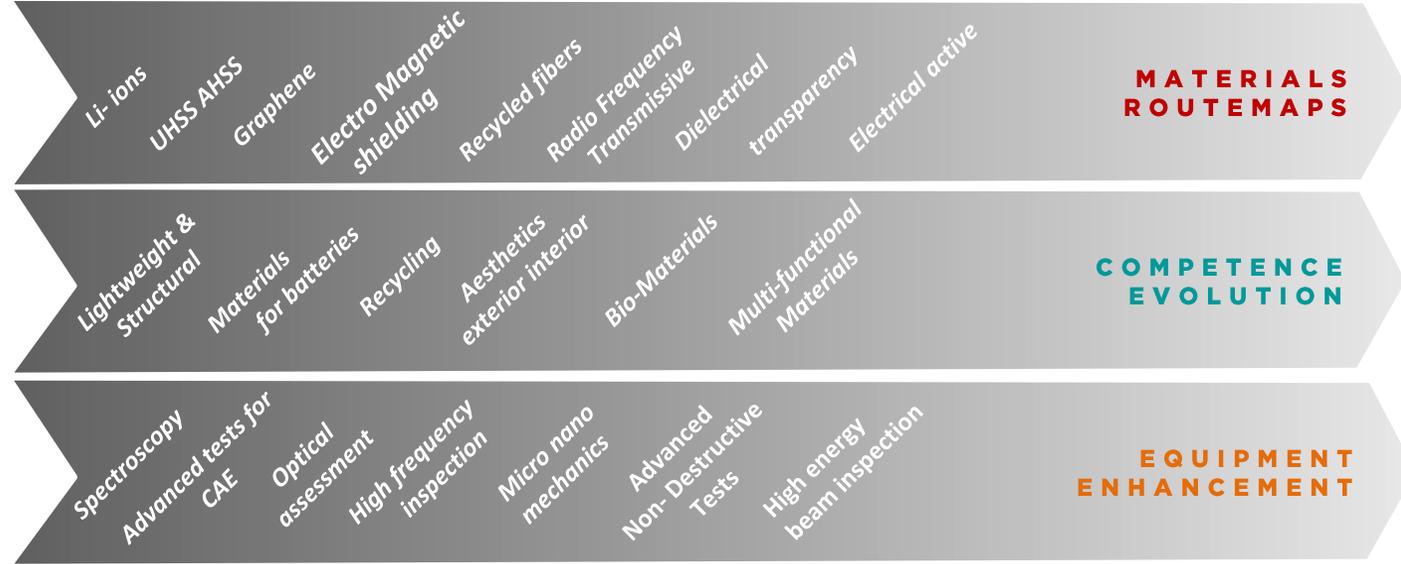
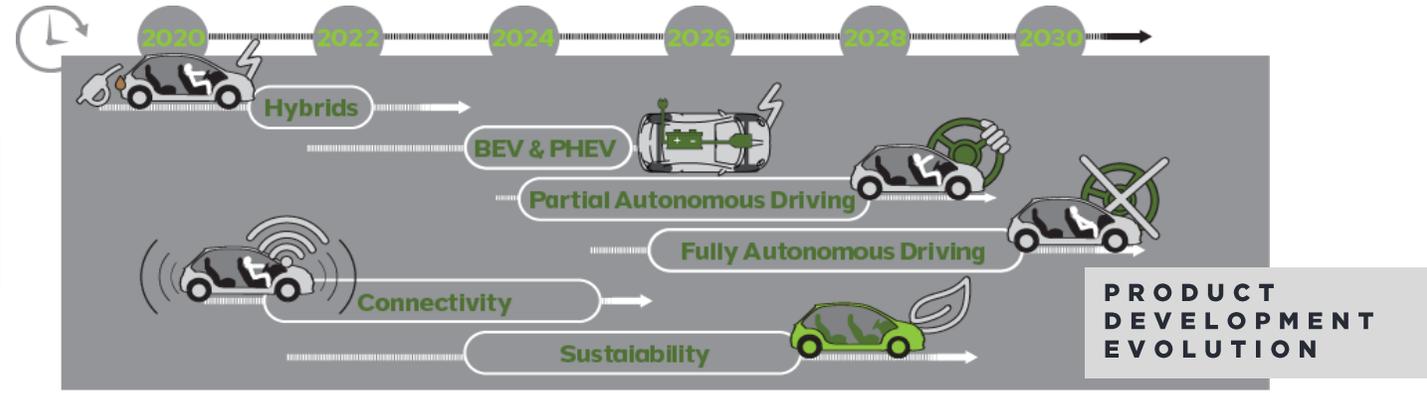
Safety

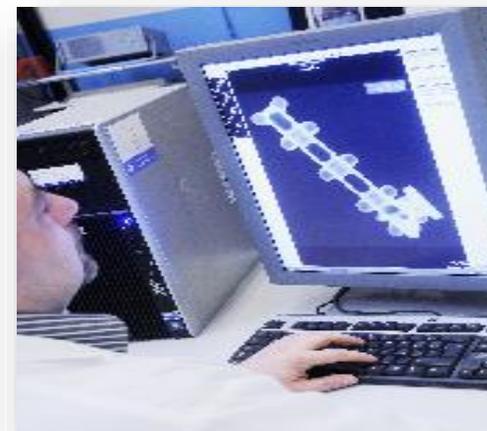
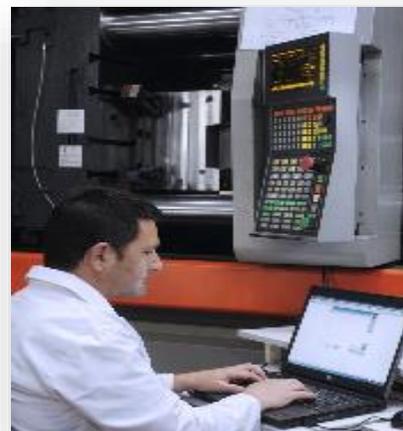
Weight

Ecology

Recycling

Environment

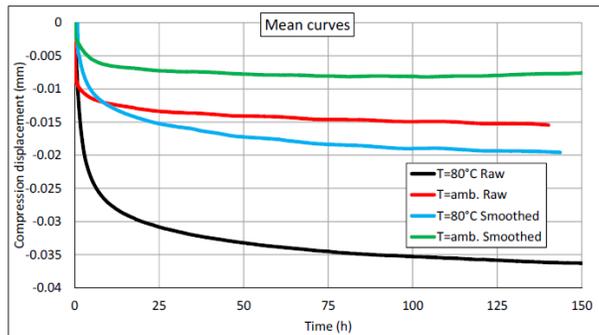
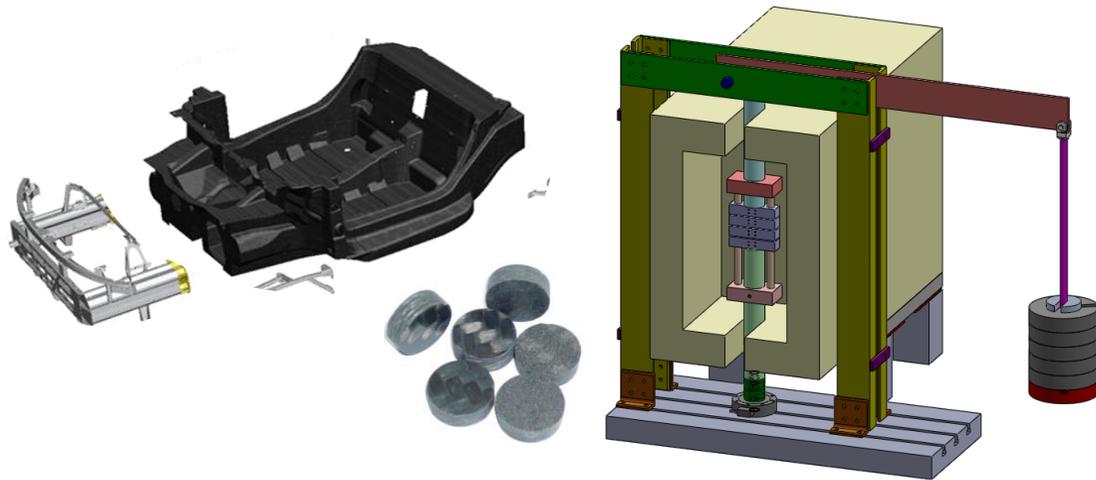




Challenge

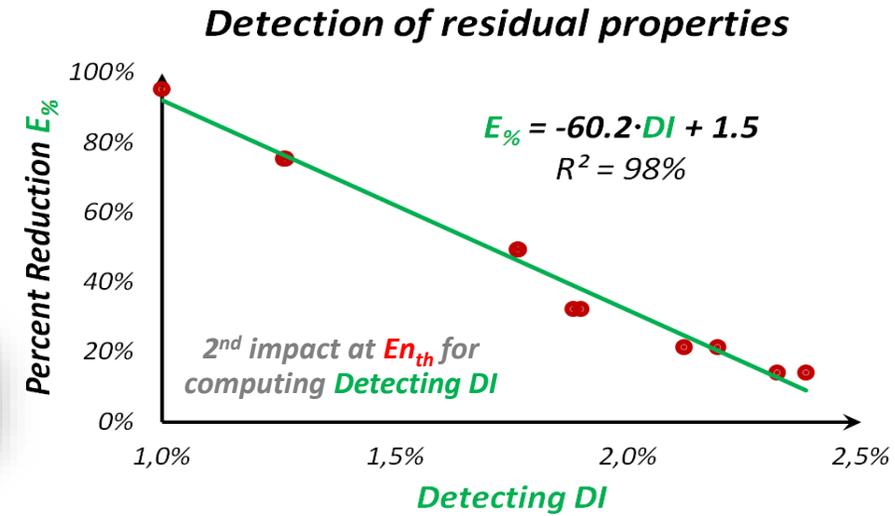
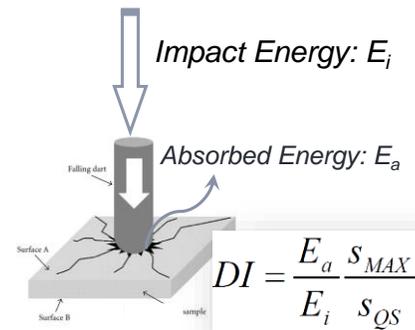
- Develop further materials competences to support new product contents (electrification, sustainability)
- Assure advanced materials testing methods to increase virtual model correlation to reduce physical testing
- Availability of global materials standards to assure global sourcing opportunities

Creep in compression of dissimilar material metal/composites



- Built equipment and standard optimized
- Verified surface finishing influence
- Support to production plant

Structurally graded composites and their failure behavior



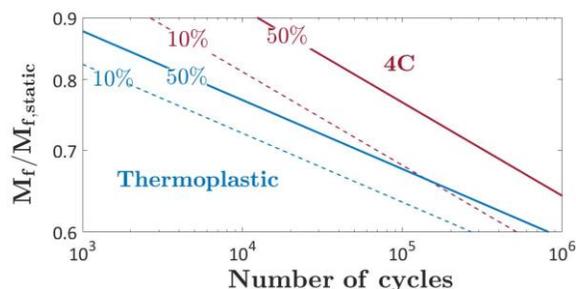
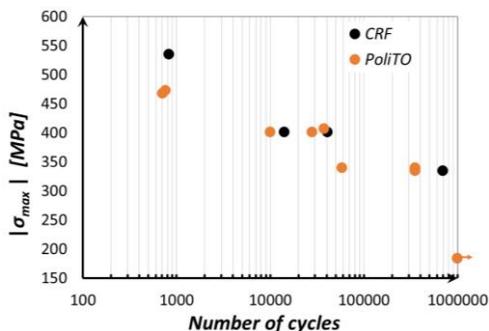
- Prediction of local residual properties through NDT (detecting DI)
- FEM analysis of damaged components and experimental validation
- Mechanical characterization of the investigated materials
- Stress distribution in a component made of the reference material

Fatigue mechanical behavior and failure mode of structural thermoplastic composites

Thermoset from Alfa 4C (Carbon twill 2x2, Epoxy resin)

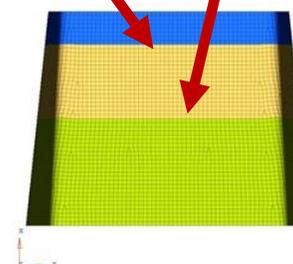
Thermoplastic (PA 66 glass fibers)

Thermoplastic (Caprolactam PA6 carbon fibers)



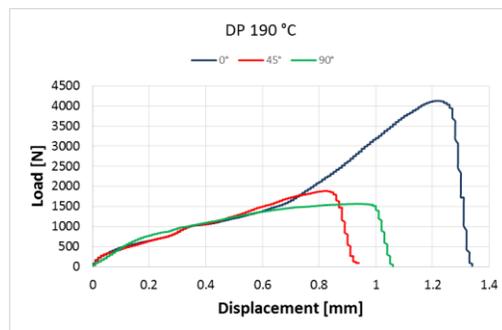
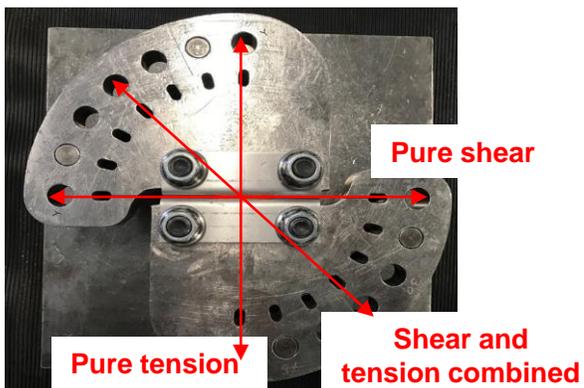
- Bending tests round robin at PoliTO and CRF
- Support in the definition of a methodology for tensile-tensile fatigue tests at CRF
- Different fatigue testing typologies were experimentally compared
- Comparison between thermoset and thermoplastic component:
- Bending tests on Caprolactam specimens for CRF

Advanced crashworthiness assessment for innovative lightweight materials



- A fully defined procedure for crashworthiness tests on composite specimens.
- The exploitation of experimental results to tune material parameters for CAE models.
- An accurate prediction of the crashworthiness of the demonstrator through CAE models.

Fatigue mechanical behavior and failure mode of structural thermoplastic composites

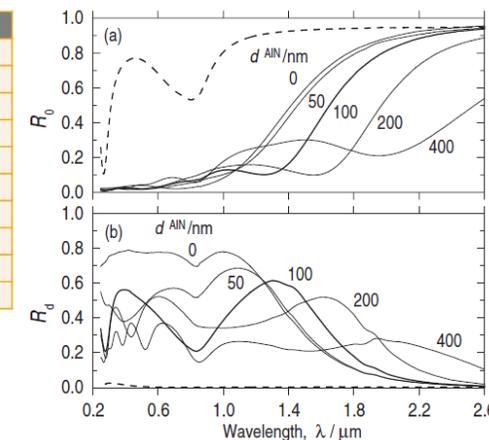


Advanced surface functional and aesthetic coatings



➤ Development of new Selective surface activation induced by laser

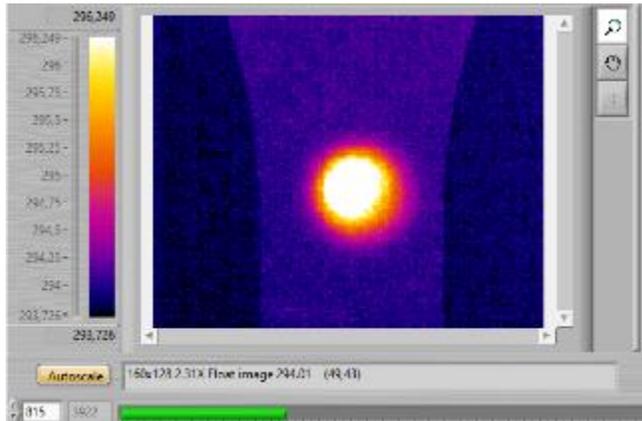
FILM SOTTILE	RANGE COLORAZIONI	PARAMETRO VARIATO
TiN	metallic--->gold yellow ---> brunish	(increase nitrogen flow)
TiON	yellow/pink ---> dark yellow ---> dark blue	(increase % oxygen)
ZrN	metallic grey---> yellow greenish--->yellow	(increase nitrogen flow)
Al+AlN	wide range of colours	(surface roughness, transparent film)
TiON	Light blue--->white metallic	(increase bias voltage)
ZrCN	greenish yellow --> reddish yellow	(increase % carbonium in nitride)
TiVN	like TiN with lower chroma	(increase % vanadium)
ZrVN	like ZrN with lower chroma	(increase % vanadium)
TiCxN1-x	Reddish gold ---> brown	(x= 0.5 - 50)
TixAl1-xN	oro ---> brown-black	(x=0.1-70)



➤ Development of new sputtering coating for aesthetic parts

- Mechanical characterizations of joints and hybrid joints at 0°, 45° and 90°
- Tests performed on Al-Al joints and Al-Fe
- Experimental tests implemented for design and CAE
- Compatibility with production processes (curing during cataphoresis treatment)

Non-destructive techniques: Active thermography (AT) & damage and defects identification



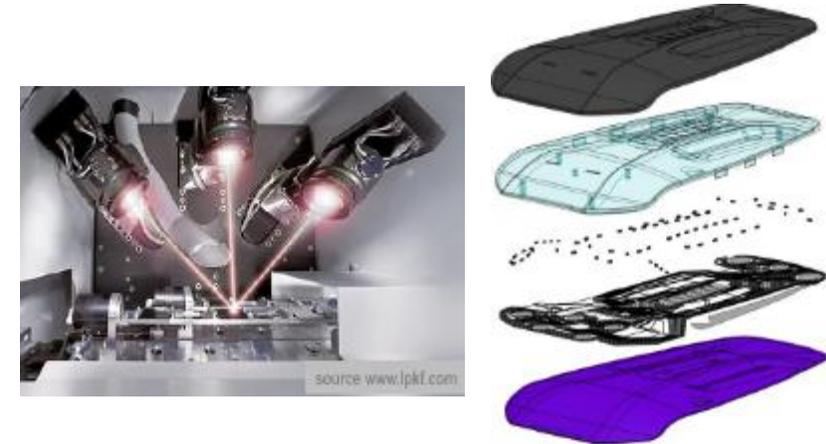
- Defects in PCB and multichip (atypical T distributions, cracks)
- Residual stresses of automotive components due to molding processes (experimental data useful to FEM results)
- Defects of 3D-printed polymers and metallic structures

Antimicrobial anti viral coatings for interior exterior



- coatings with antibacterial/virucidal functionalities for automotive applications
- Sanification of internal surfaces
- Air sanification by antibacterial/virucidal coated air filters

Embedded Electronics for intelligent surfaces



- Materials developments: electrically conductive additive in resins, selective plating
- Materials assessment: Adhesion strength, plating selectivity, electrical resistance
- Laser process activation
- Standardization of methods: EE vs materials

Maximum Likelihood Principle



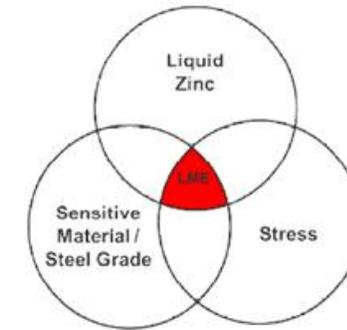
- Statistical method that could permit to reduce the samples number to build the fatigue curve
- Reduce the testing time

X-Ray Computer Tomography- Custom built



- Large component testing (sample size: max 500 mm x 500 mm x 500 mm)
- Development of NDT methodologies
- Mechanical testing device for in-situ analysis

Spot welding and hybrids characterization and Liquid Metal Embrittlement



- Parameters to limit or avoid the liquid metal embrittlement in spot welding of AHSS
- LME influence on the fatigue properties
- LME influence on the crash properties

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CRF - MATERIALS ENGINEERING METHODS & TOOLS