

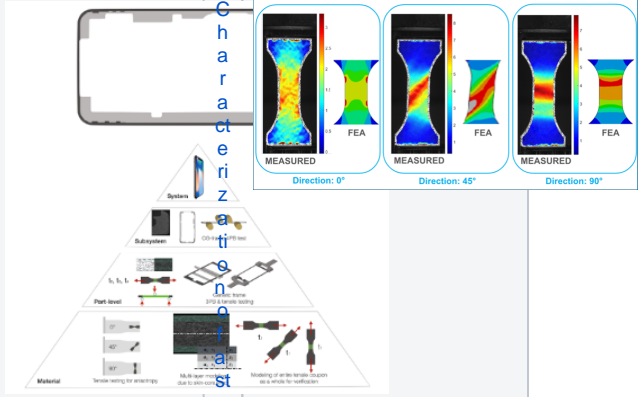


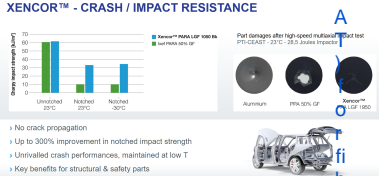
Impact (under construction)

APPLICATIONS

THEORY, KNOWLEDGE, & MODELS

CAPABILITIES

Standard impact tests such as Charpy/Izod tests or dart (multi-axial) impact tests are mainly part of the Syensqo Core Labs capabilities. The description of the related equipment can be found in the below links (core labs wikispages):

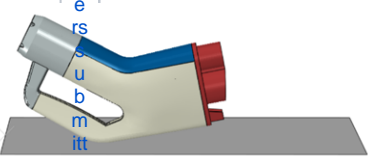
<p>Drop tests on smart devices ...</p>	 <p><i>Illustration: validation of an impact model for CG frames</i></p>
<p>Impact tests on Battery enclosures / protection boxes</p>	 <p><i>48V battery enclosure (link to design study)</i></p>
<p>Bike components</p>	 <p><i>e-bike wheels and frame in Xencor PARA LGF-1050 (Stajvelo/Domteknika)</i></p>
<p>Promotion of Xencor product family for better impact performance</p>	 <p><i>The long fiber reinforced grades (Xencor) offer a <u>higher resistance to failure propagation</u> once the crack/notch is initiated.</i></p>

Core Labs	Available equipment and link to description
AMC-Bollate	<ul style="list-style-type: none"> Charpy / Izod Equipment at room temperature. Specimens can be conditioned from -40 to +100 °C. <p>Link to the Core Labs Wikispages</p>
PCL-Alpharetta	<ul style="list-style-type: none"> Charpy / Izod (-40°C to 23°C) Multi-axial Impact test (-40 °C to 100°C) <p>Link to the Core Labs Wikispages</p>
PCL-Shanghai	<ul style="list-style-type: none"> Charpy / Izod Drop-weight impact test <p>Link to the Core Labs Wikispages</p>

The Brussels analytical Lab (Explorer Center, Haren) is also equipped with impact test capabilities. On top of pendulum impact tests and dart impact tests, this Lab has the capability to characterize the behavior of our polymers at high strain rates using a Very High Speed (VHS) tensile test machine.

Brussels Labs equipment	Description
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Characterization of materials model (DGI MAO) fiber reinforced polymer

<p>Drop test on EV charging guns</p>	 <p><i>Studies conducted internally (virtual prototyping) but also applied on customer assemblies involving sub-elements made of IXEF 1022 (GC, YinRong). The difficulty is here to find the most critical position and to account for all the internal elements...</i></p>
<p>...</p>	

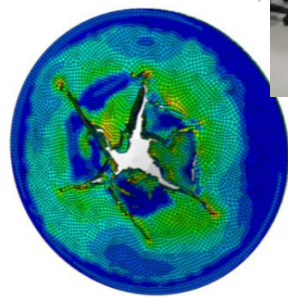
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Very High Speed (VHS) tensile test machine



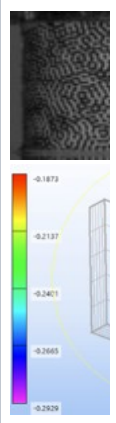
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In this report, we illustrate that the crack initiation occurs at the same moment for the short and long glass fiber reinforced grades. But, the long fiber grade demonstrates a much higher resistance to failure. propagation.

To account for this particularity, a progressive damage law is calibrated, using DIGIMAT, for the long fiber reinforced grade.


The model has been applied to a screen cover part (for car interior) submitted to a head impact test.



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The VHS m particularly the calibrat advanced r to run struc simulations account the strain rate : fiber orient: materials (s and Model" more detail

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<p>Dart Drop Tower</p> 	<ul style="list-style-type: none"> • For co mediu • Energy to 180 • Speed 24 m/s • Tempe to 200 • Comp: speed
<p>Charpy/Izod/Tensile impact test</p>	<ul style="list-style-type: none"> • Tempe -50°C • Energy (hamn

Some impact related test capabilities are also available in our AD Labs:

AD Labs	Available equipment and description
Bollate	<ul style="list-style-type: none"> • Ball drop test for PVDC
Alphar etta	<ul style="list-style-type: none"> • NA
Shang hai	<ul style="list-style-type: none"> • Ball drop test for PVDC
Fuji	<ul style="list-style-type: none"> • Izod/Charpy (Instron Ceast 9050): <ul style="list-style-type: none"> ◦ Temperature: 23°C ◦ Energy levels for Izod: 2.75J, 5.5J, 11J ◦ Energy levels for Charpy: 2.5J, 7.5J, 15J • Tensile impact strength • Falling weight impact test: <ul style="list-style-type: none"> ◦ Impactor: hemispherical, D=12.7mm (steel) ◦ Temperature: 23°C only ◦ Energy range: up to 19.355J

Finally, some "exotic" capabilities exist on the market to measure stress-strain curves at extremely high strain rates (at 1000/s for instance). An example is the so-called "Split Hopkinson Tensile Bar" where:

- The specimen is fixed between two different long bars (an incident bar and a transmission bar);
- a stress wave is generated, typically by a gas gun or a striker that impacts the incident bar, and transmitted through the specimen to the transmission bar;
- the strain in the sample is calculated by analyzing the differences between the incident, the reflected and the transmitted strain waves measured with strain gauges.

However, if the principle looks attractive on the paper, our practical experience based on different trials with external labs is less positive. Indeed, in many cases, we obtained measured stress-strain curves with a high level of noise making the post-processing and the calibration of material cards complex (and even inaccurate...).