

INDAR debonding-on-demand primer for composites

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Made in the EU: Creating markets for circular composites

Why debonding-on-demand?

Common point between these products?



Bonding = roadblock for composites circularity



Why debonding-on-demand?

Strong regulatory pressure...

E.g: new legislation amends regulation (EU) 2018/858

Source: <https://www.iom3.org/resource/european-council-adopts-position-recycling-of-vehicles-at-the-end-of-life.html>

...and higher consumer expectations vs sustainability...

Increased volume & weight

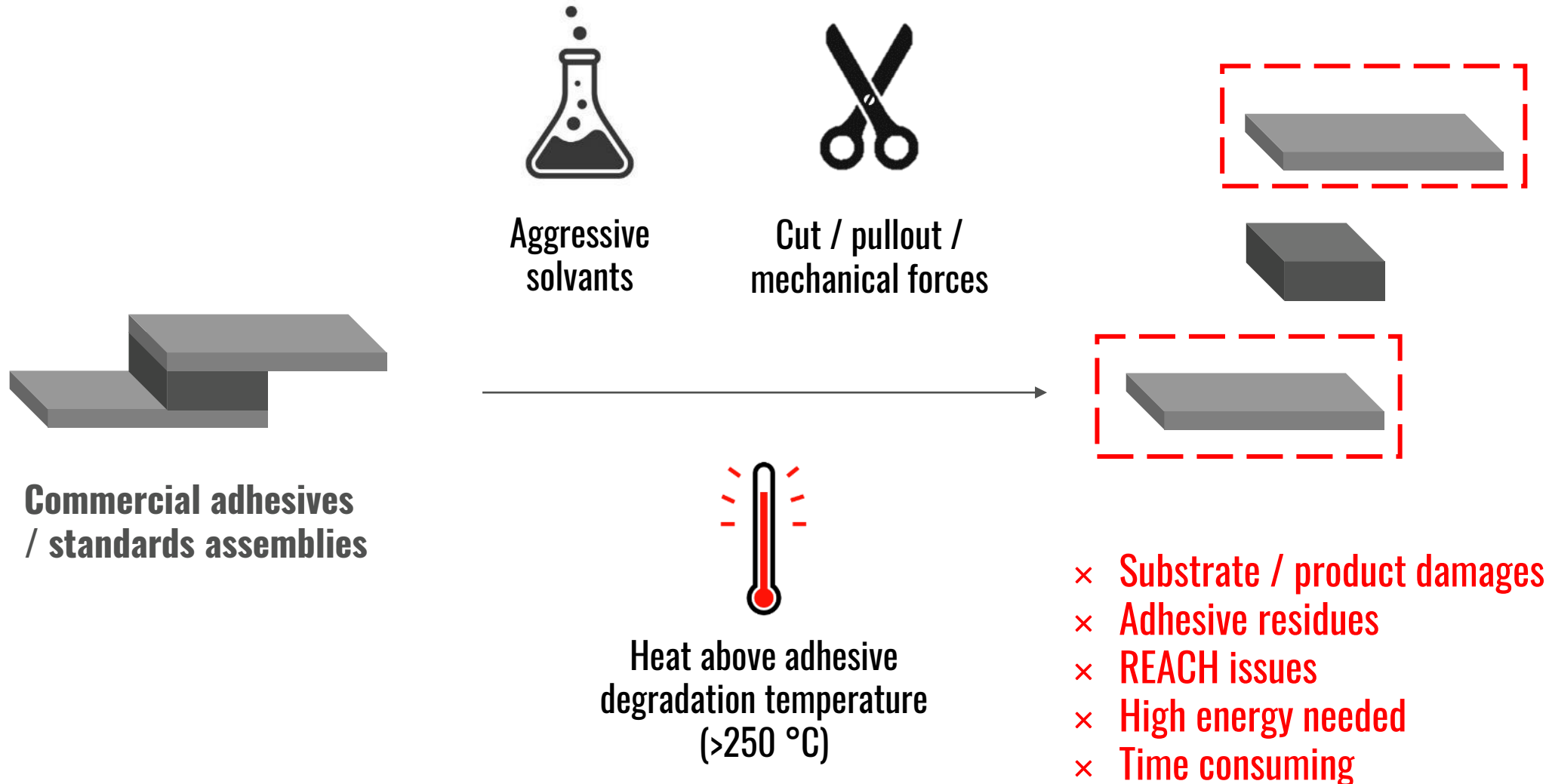


...as well as extended use of multimaterials.

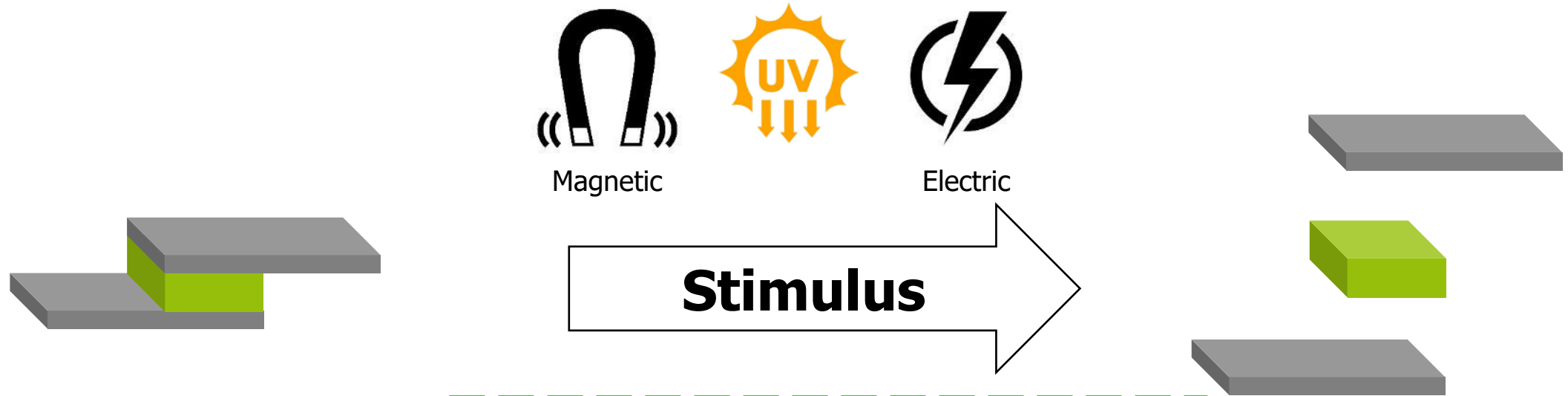
Increased composite use, cars electrification, shorter lifecycle (10-30 years)



Usual debonding techniques



Innovative debonding-on-demand techniques



Special debondable systems

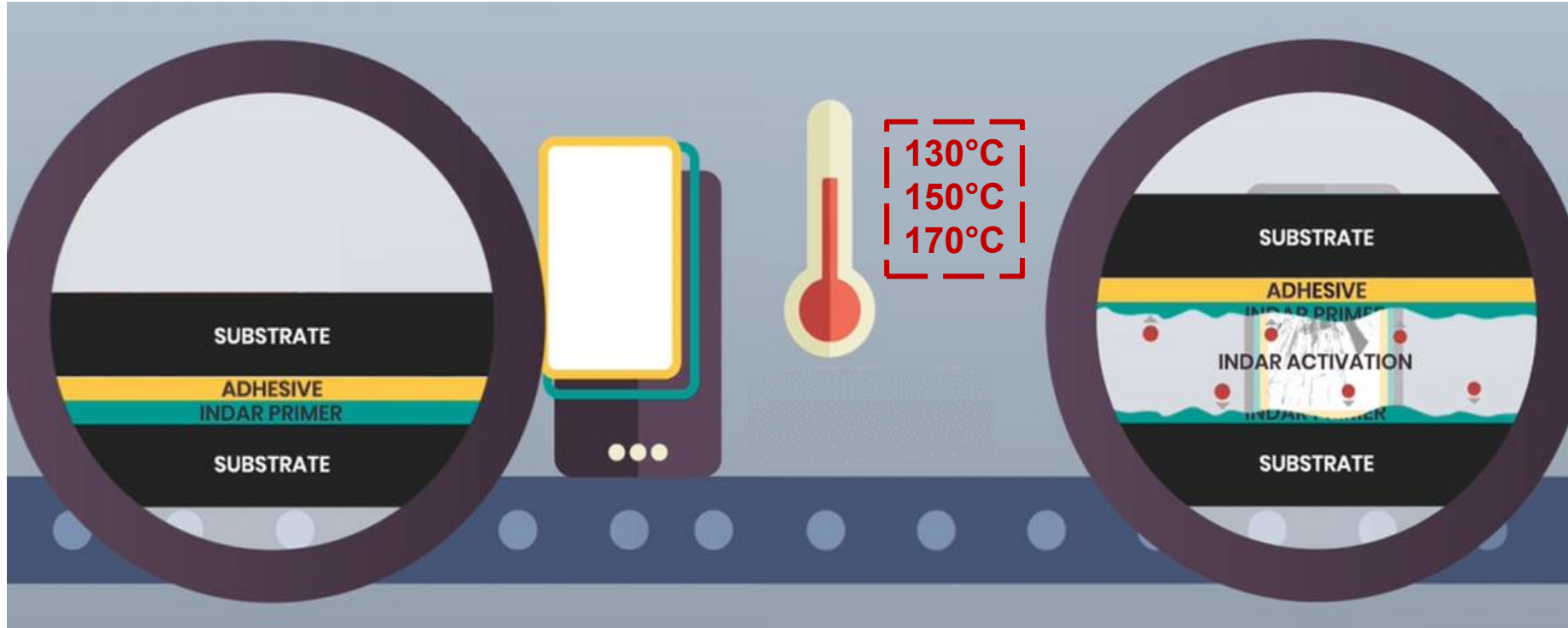
Main challenge = **maintain properties during service**

Convection Induction Infrared Microwave Heating blanket

Short time & moderated temperature heating

- ✓ Limited energy
- ✓ Fast & localized
- ✓ Can be implemented at industrial scales

INDAR primer



- ✓ Alcohol-based formulation, fast drying
- ✓ Same deposition process as a standard primer ; 10-15 µm thick dry
- ✓ Compatible with numerous commercial adhesives, no impact on service properties
- ✓ Limited residues after heat triggering ; easily cleanable if needed



Applus⁺
RESCOLL

indar 



INDAR primer

- ✓ Activation and service temperatures:



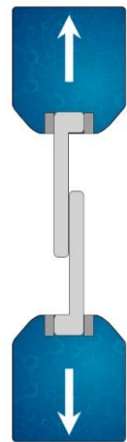
- ✓ Specific properties: adhesion on difficult substrates, making compatible with specific adhesives, color/UV indicator, viscosity tuning...)
- ✓ Most suitable heating way

Some results at coupons level – mobility

Configuration¹: CFRC²/INDAR³/adhesive⁴/INDAR³/CFRC²

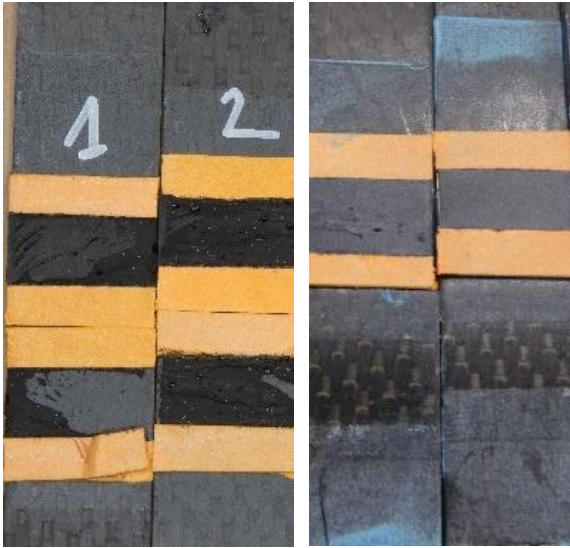
1. Lap-shear according to EN 1465 / ISO 4587 standard
2. Sanded carbon fiber reinforced composite (CFRC) from EDAG
3. INDAR primer 170 – bar coater 100 µm wet – 10-15 µm dry – ambient drying
4. Structural **2K epoxy adhesive** (commercial reference used in automotive industry)

Aging conditions	LSS (MPa)	Failure type
RT	21.6 ± 2.3	Substrate failure
3 weeks of cycles -40 °C ; 80°C/80% RH	17.5 ± 1.2	AF INDAR/substrate
22 h soaking at 80 °C in glycol solution	22.1 ± 1.1	Substrate failure



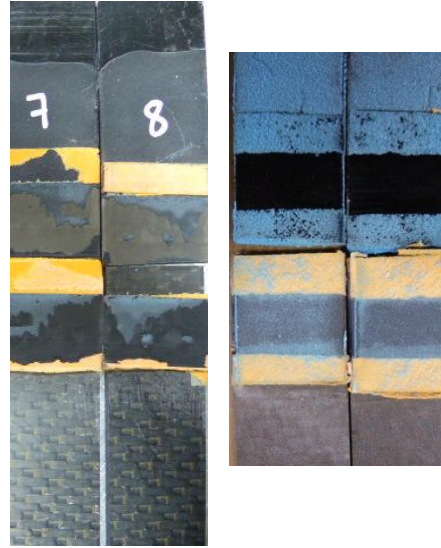
- ✓ High mechanical performances >15 MPa.
- ✓ Good glycol resistance, fair climate aging resistance.
- ✓ Spontaneous debonding after thermal activation, even at cold stage.
- ✓ Clean substrates recovered.
- ✓ Ongoing improvement of mechanical resistance at 80 °C and vibration resistance.

Other SLS configurations - mobility + rotor-blade



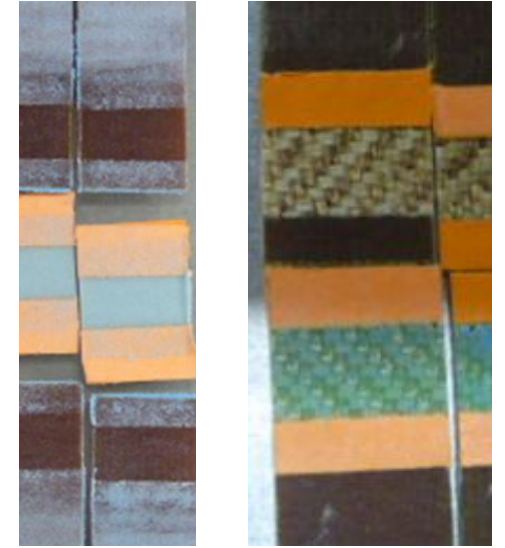
CRRG/INDAR 150/2K PU*/INDAR 150/GFRC
**Commercial PU suitable for car parts bonding*

- ✓ Cohesive failure
- ✓ Spontaneous debonding after oven activation at 150 °C



CRRG/INDAR 170/2K epoxy/INDAR 150/e-coated steel

- ✓ High mechanical performances >15 MPa.
- ✓ Spontaneous debonding after oven activation at 150 °C (e-coated side).



GRRG*/INDAR 150/2K epoxy**/INDAR 150/GFRC*

- *Glass fiber reinforced composite (GFRC) with peel-ply from INVENT*
***Commercial ref suitable for rotor blades bonding*
- ✓ Substrate failure at ~10 MPa.
 - ✓ Good debonding.

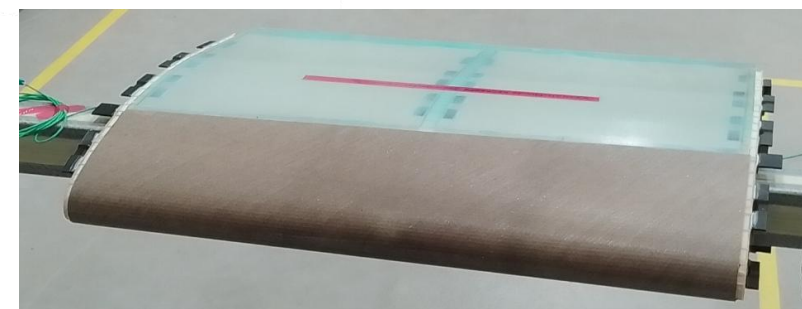
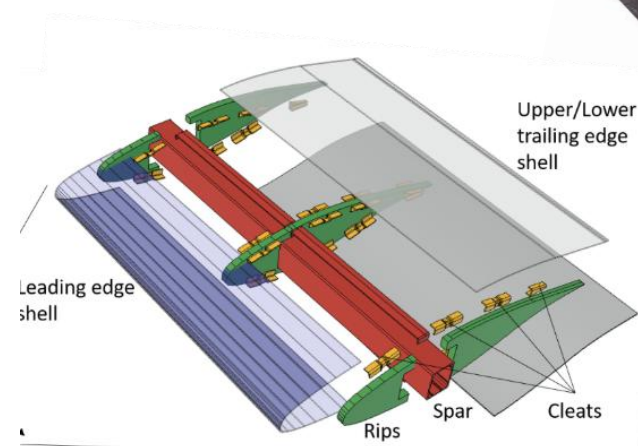
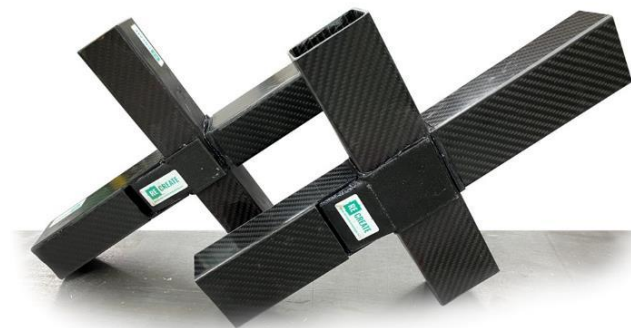
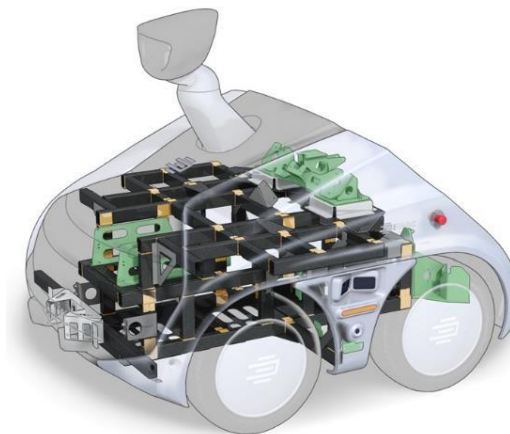
Conclusion

INDAR primer offers:

- Versatility (adhesive technologies, substrates, applications)
- Good aging resistance
- Easy and clean debonding, even at cool stage
- Fast using more suitable heat techniques (e.g. induction)

Promising demo-cases:

- EDAG cityboat redesigned
- REST-T : segmentable wind-rotorblade redesigned
- CO₂ emission reduction / improved LCA – see demonstrator inputs



**Thank you for your attention!
Question?**

