

FLANDERS  
**MAKE**

DRIVING INNOVATION IN MANUFACTURING

# Adhesive Joining of Composite Materials

Jeroen van Kasteren

## Advantages

no damages on the substrates

weight reduction

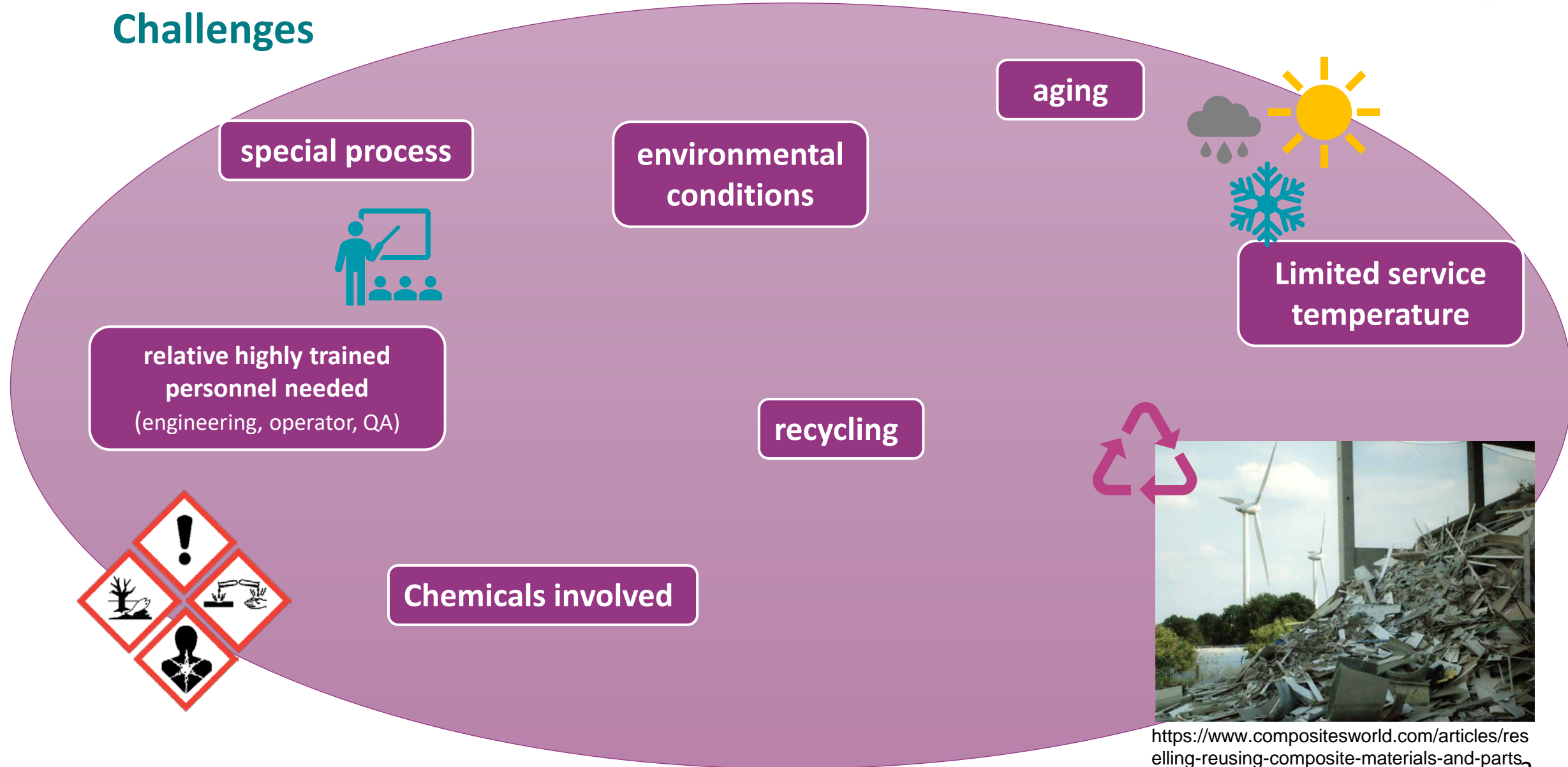
even force distribution

bonding dissimilar materials  
(e.g. Metal – Composite)

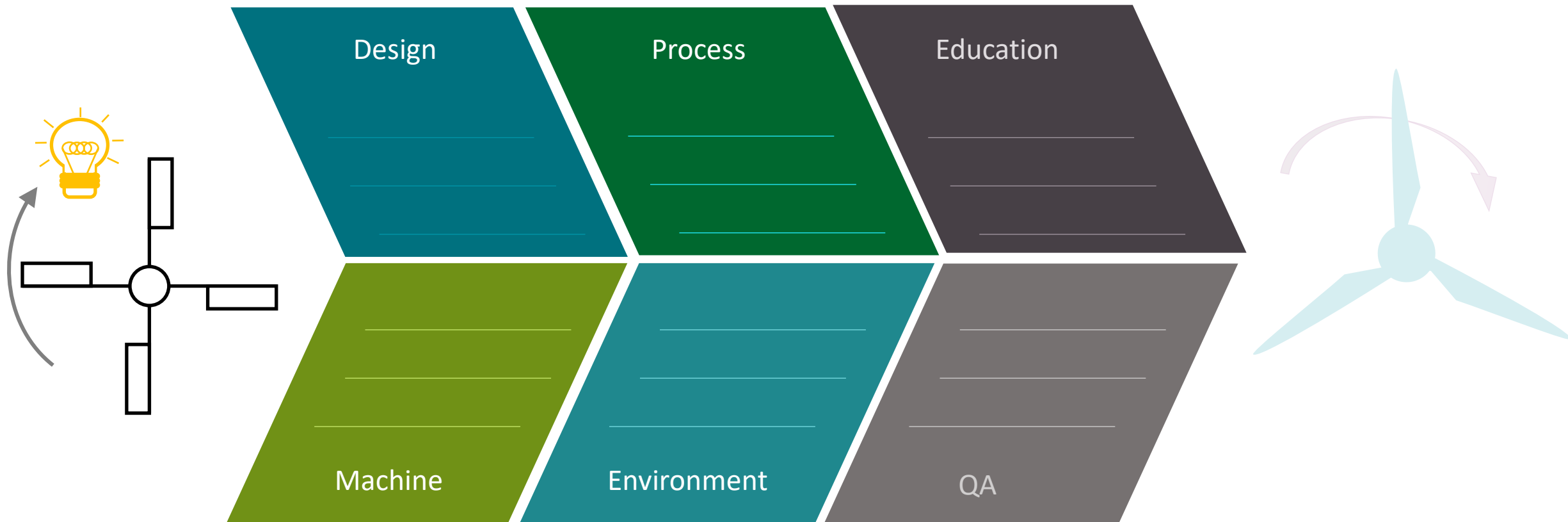
add extra property,  
sealing / damping



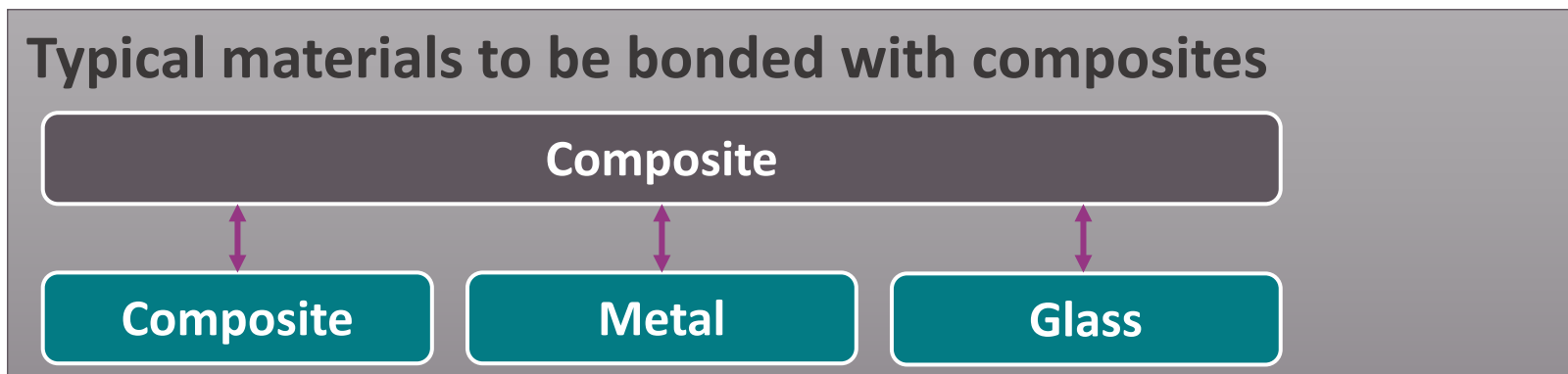
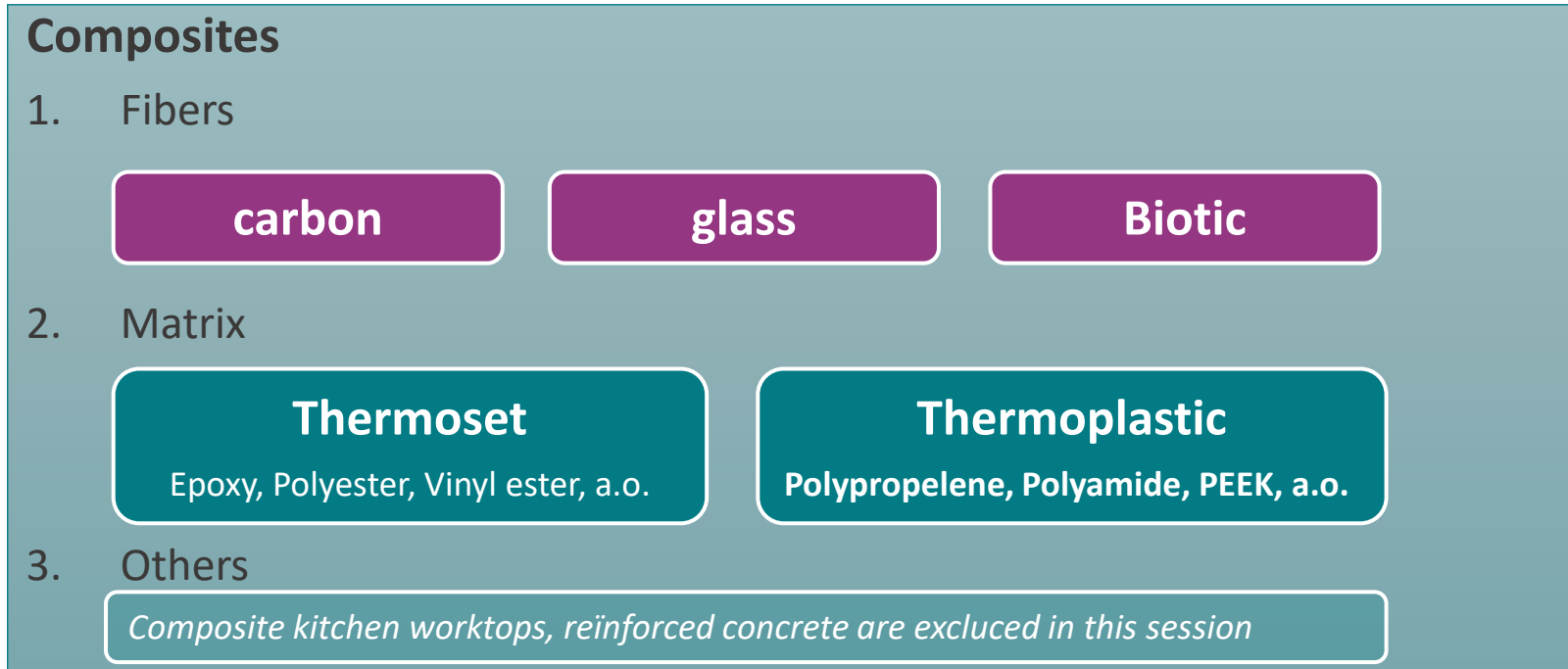
## Challenges



## Plan to a reliable composite joint



## Design - Substrates



## Design - adhesives

### Design Properties

**bonding strength – elongation – a.o.**

### Processing parameters

**viscosity - pot life - curing time – a.o.**

### Structural adhesives

**Epoxy**

**1C / 2C PU**

**MMA**

### Non structural adhesives

**MS-Polymer**

**1C PU**

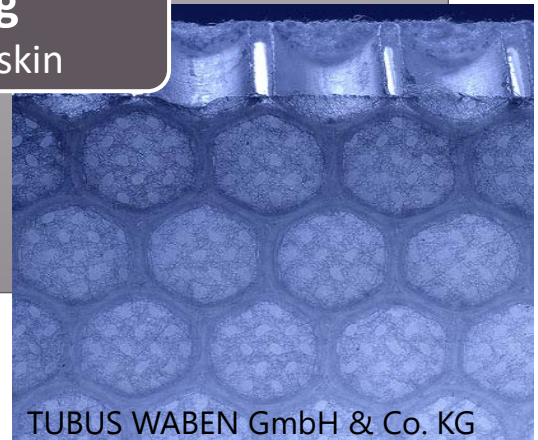
**Silicone**

**PSA**

### Others

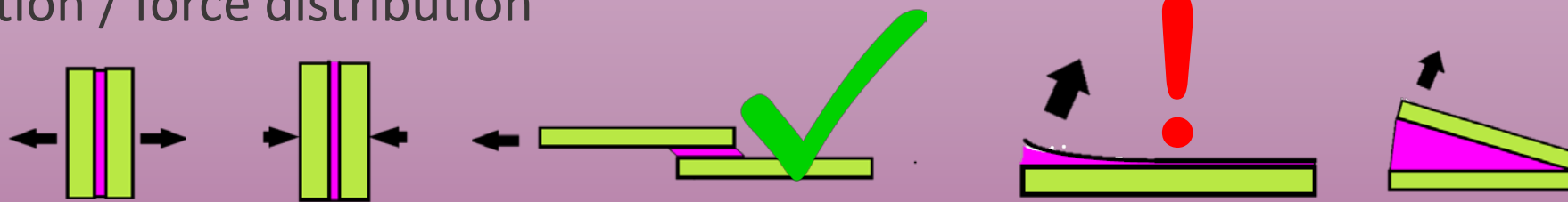
**mechanical locking**  
(or anchoring) in a fleece skin

**(Prepreg) Hotmelt**



## Design - Bond line design

Direction / force distribution



Protection

- Shielding of radiation (UV)
- Protection against ingress of fluids



Bond line thickness and bonding area

- Defined in geometry of substrates
- tolerances

Testing

- Lap shear peel samples / peel samples
- Durability: aging and fatigue

# Method

## Surface treatment

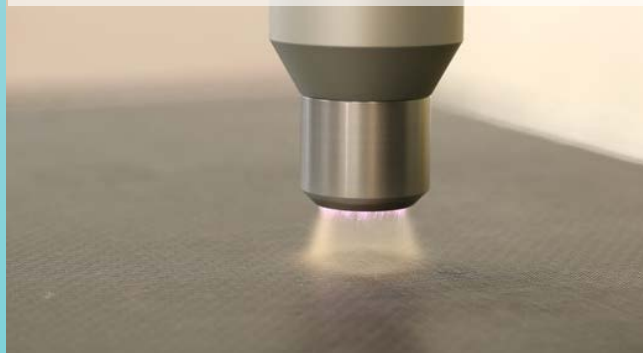
abrading



Cleaning

Physical treatment

<https://www.compositesworld.com/articles/surface-treatment-for-adhesive-bonding-thermoset-vs-thermoplastic-composites>



Primers

Peel-Ply

<https://www.ultimate-aerospace.com/products/strucural-carbon-fiber-plates>



## Adhesive

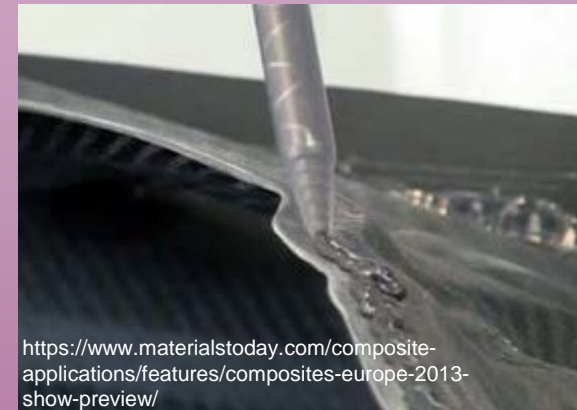
acclimatize

dosing & mixing

apply

join

fixate



<https://www.materialstoday.com/composite-applications/features/composites-europe-2013-show-preview/>



## Machine

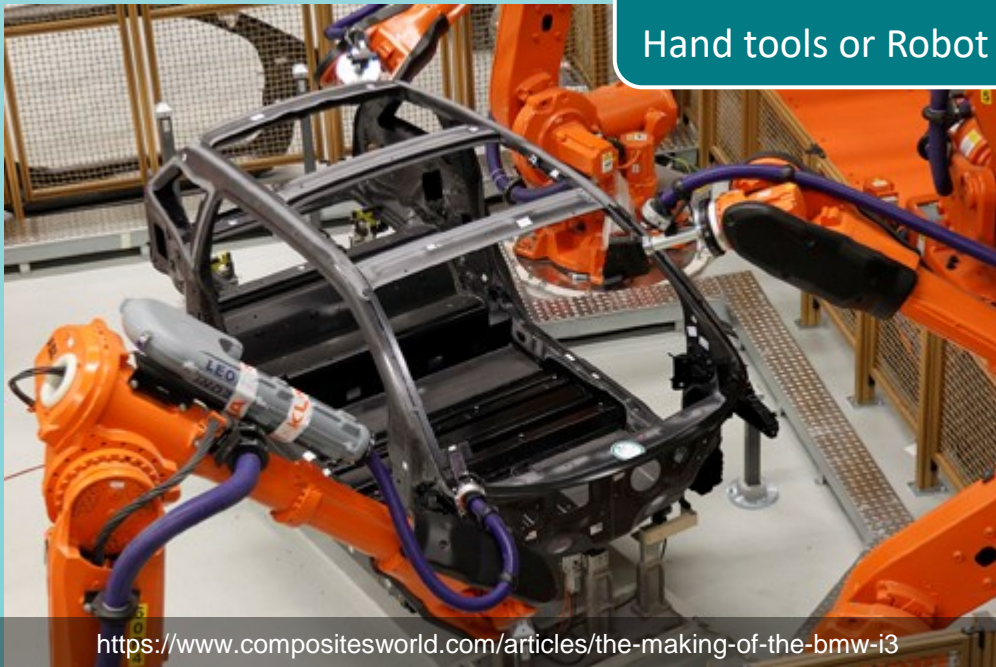
Define tools and grade of automation

**Dosing & mixing**

By hand or automatic

**Robot / Cobot for applying and joining**

Hand tools or Robot / Cobot



<https://www.compositesworld.com/articles/the-making-of-the-bmw-i3>



**Tools for fixation**

Clamps, press, vacuum dome,

# Quality Assurance

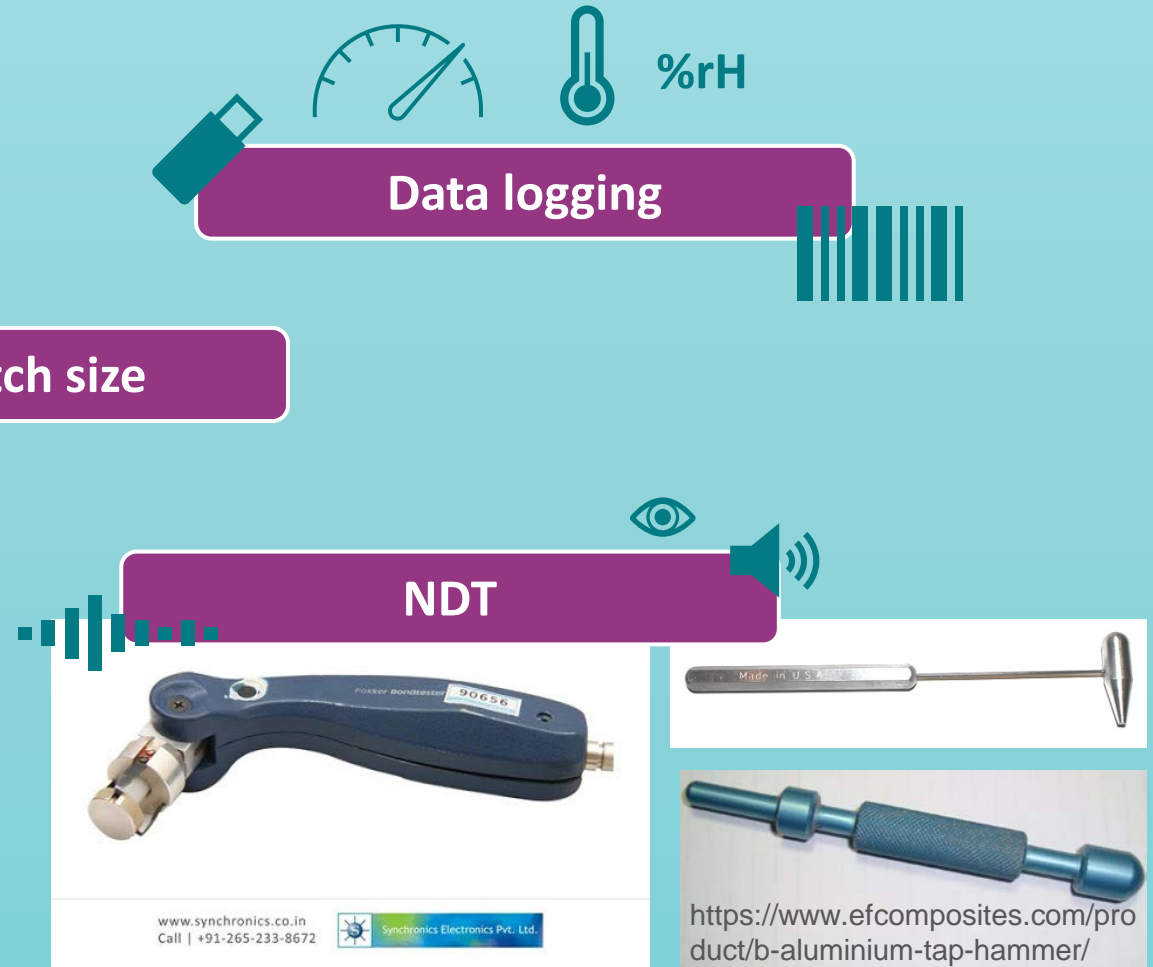
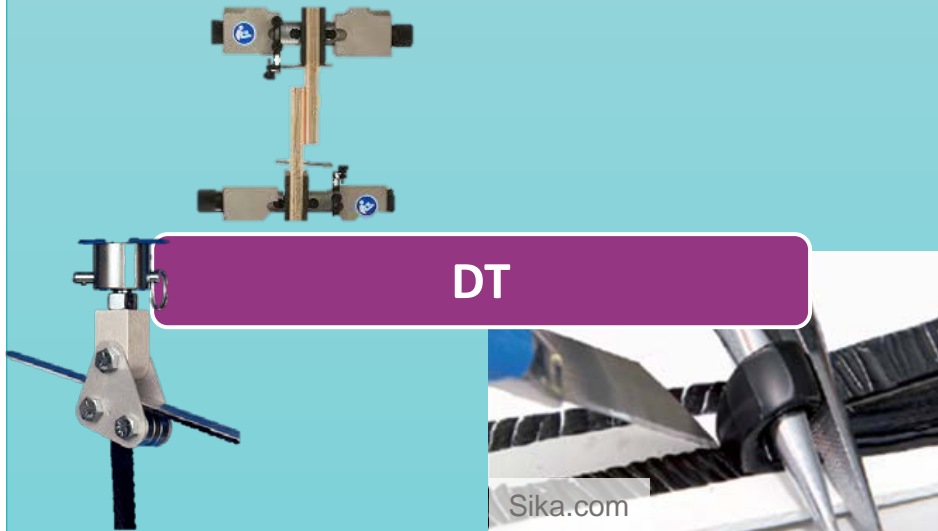
Define Responsibilities

Data logging

Define Batch size

NDT

DT



## Environment

**Contamination / Pollution  
Control**

**Working Conditions**

**Controlled storage**

**Operating Conditions**

**Local regulations**

# Education and standards

## Educate throughout organisation

**Adhesive Engineer**  
Responsible high-risk  
bonds  
Design and process

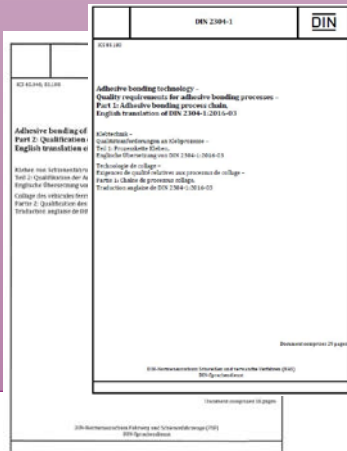
**Adhesive Specialist**  
Medium risk bond  
process and QC

**Adhesive Bonder  
operator**  
Production and QC



European diploma, worldwide recognized

## Adhesive bonding standards



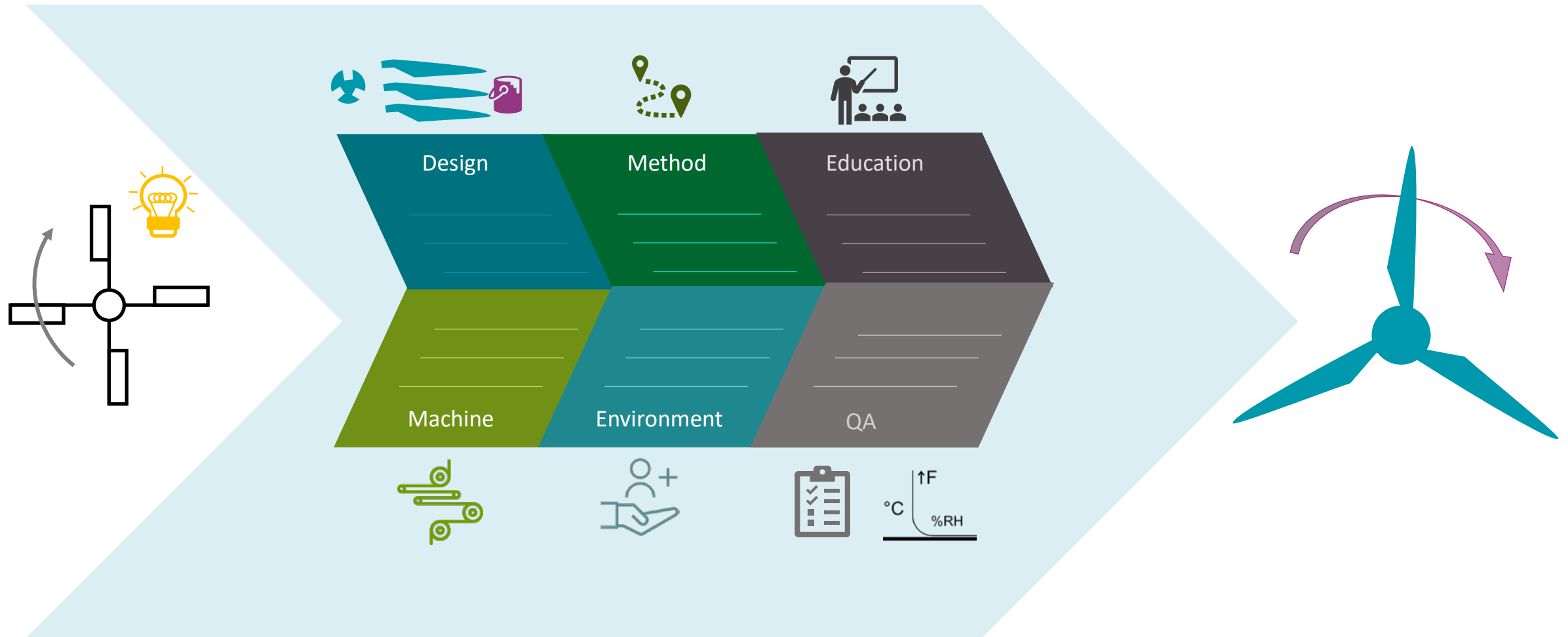
**DIN 2304**  
Standard for general industry

**DIN 6701**  
Standard for rail industry



European standard, worldwide recognized

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## Q&A