MUSP
Macchine Utensili e Sistemi di Produzione

ReclaimER

Project presentation

RETE ALTA TECNOLOGIA EMILIA-ROMAGNA HIGH TECHNOLOGY NETWORK
TECNOPOLO PIACENZA

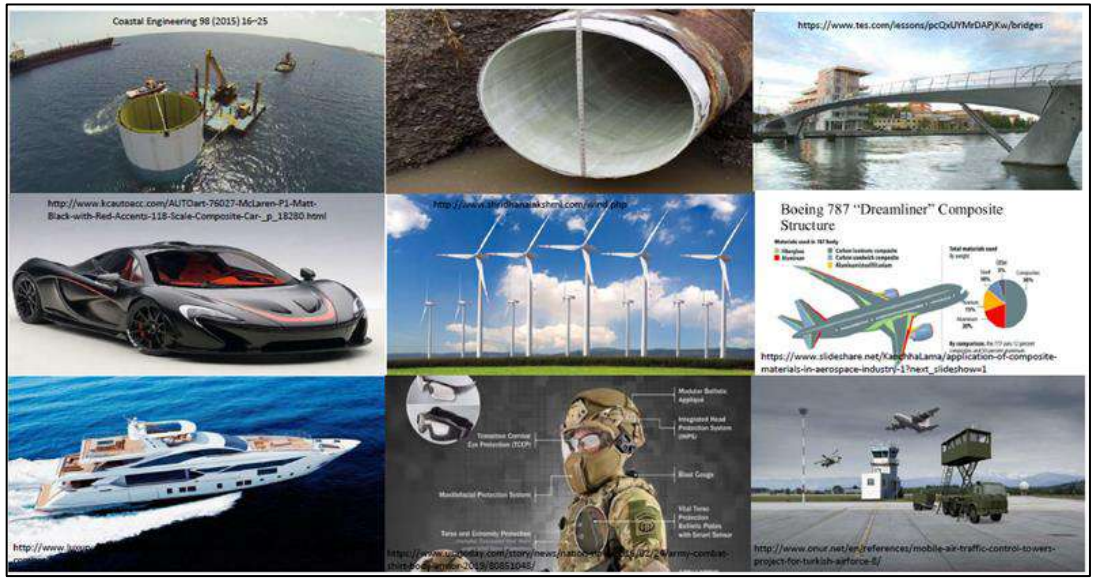
13-11-2023

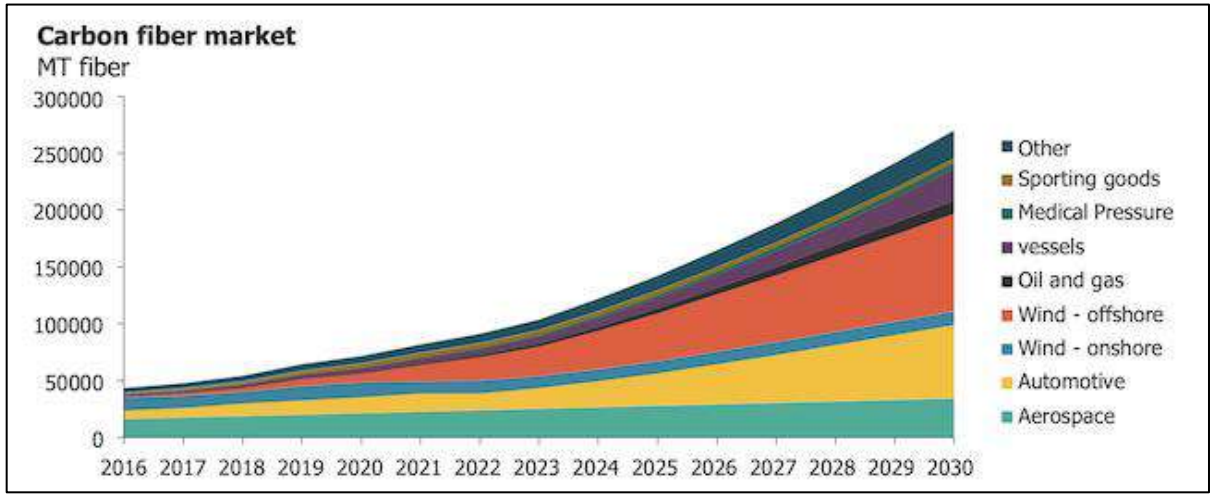
Analisi della domanda di mercato

Carbon fibre reinforced polymers (CFRP) materials are suitable for an increasing variety of industrial applications, including aerospace, automotive, construction, energy, and sport, due to their properties such as **strength-to-weight ratio** and **extended service life** *(1)*.

For this very reason, this has led to an increase in the use of this composite material in Europe, which in turns is expected to lead to managing a large amount of this End-Of-Life material in the next years *(2)*. The said trend, already growing in the last years, is expected to grow further by 2030.

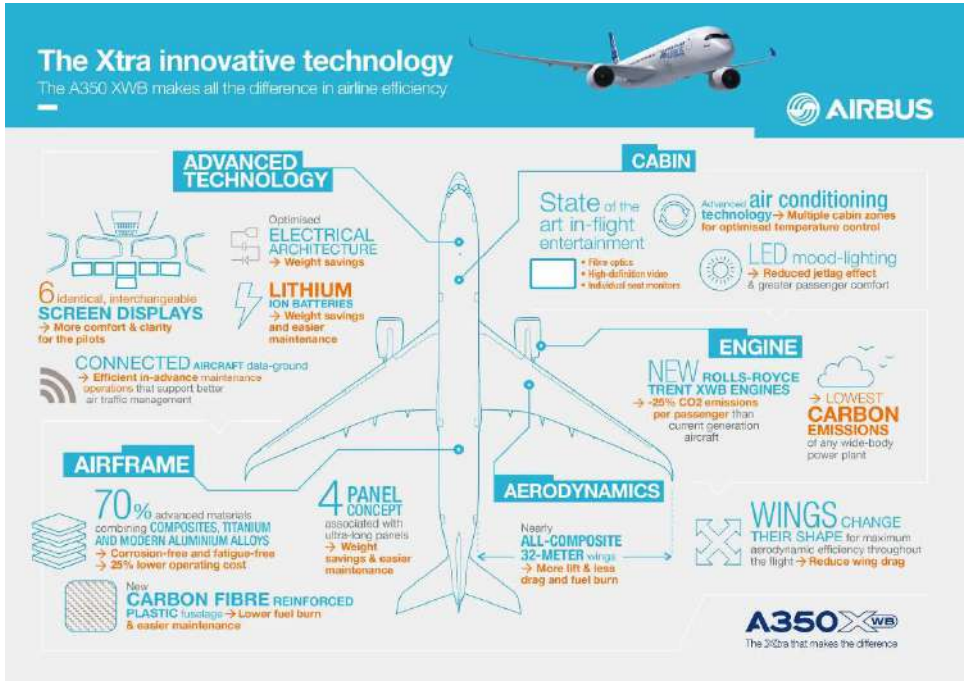
However, the growth in demand for composite material , is combined with the **problem of recycling and reusing of all the end-of-life composite material products** by 2025, a problem that will continue to be central if it is accompanied by the increasing use of composite material in the coming years.





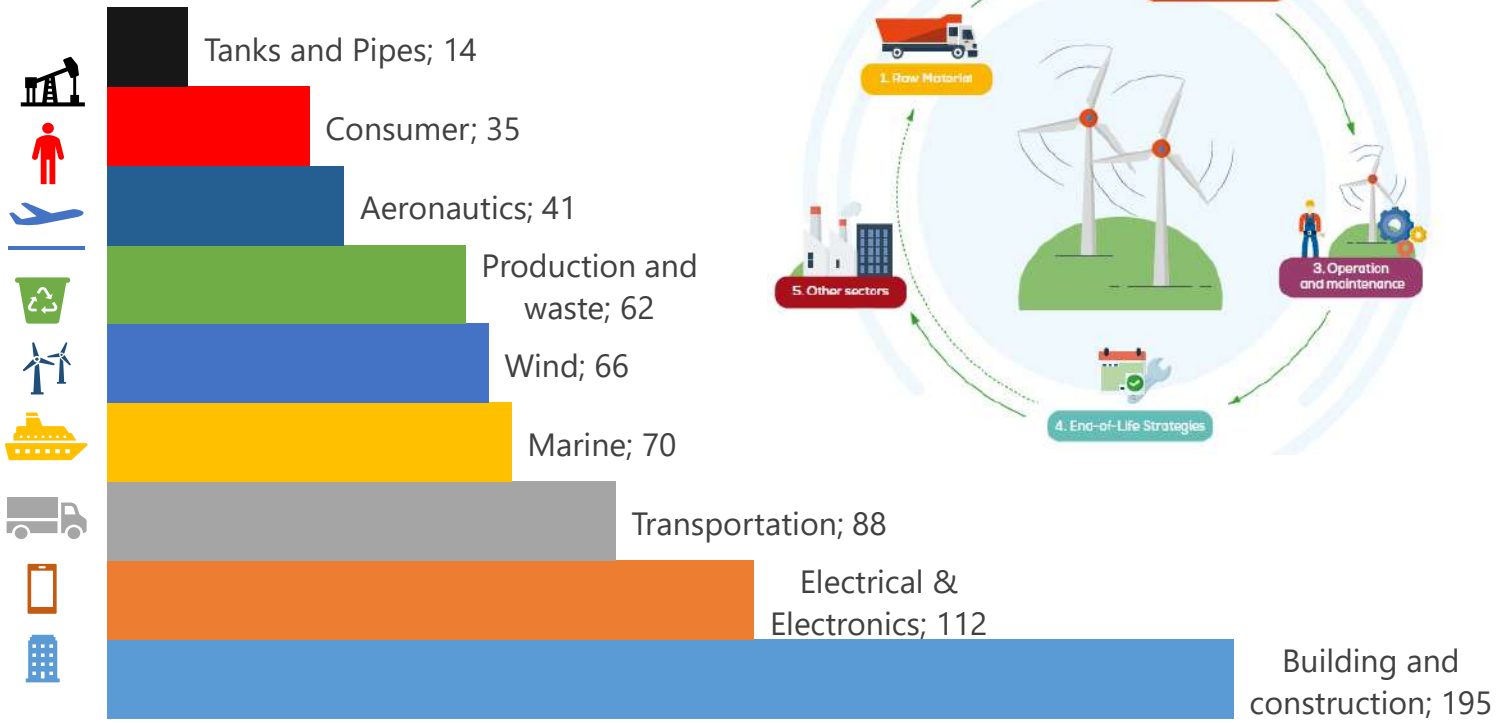
(1) Chung, 2010; Rani et al., 2021; Witten & Mathes, 2020; Zhang et al., 2020; Zimmerli et al., 2010
(2) Rajak et al., 2021; Witten & Mathes, 2020

Analisi della domanda di mercato



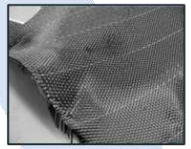
Il rapporto **resistenza/peso** e le proprietà di **lunga durata** dei materiali compositi li rendono adatti ad applicazioni industriali in diversi settori

volume elevato di **materiali compositi a fine vita** nel 2025



ReclaimER project

Fibra continua di carbonio



Prepreg di composito termoindurente

Thermal
Mechanical
Recycling

Produzione di Materiale Composito Termoindurente

Parti in Materiale Composito Termoindurente

Lavorazione del composito termoindurente

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UNIVERSITÀ DI PARMA

Produzione di materiale composito termoplastico

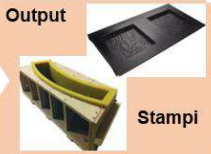
Fibra corta di carbonio riciclata

Fibra corta di carbonio riciclata

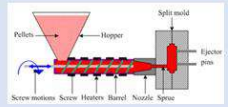
Processo additive

Processo machining

Output



Stampi



Processo injection moulding

Output

Parti «lightweight»

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TECHNOFORM S.r.l.

capellini ELECTROSPINDLES

CENTRO INTERDIPARTIMENTALE MECCANICA AVANZATA E MATERIALI DI RICERCA INDUSTRIALE

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WP6 – case studies

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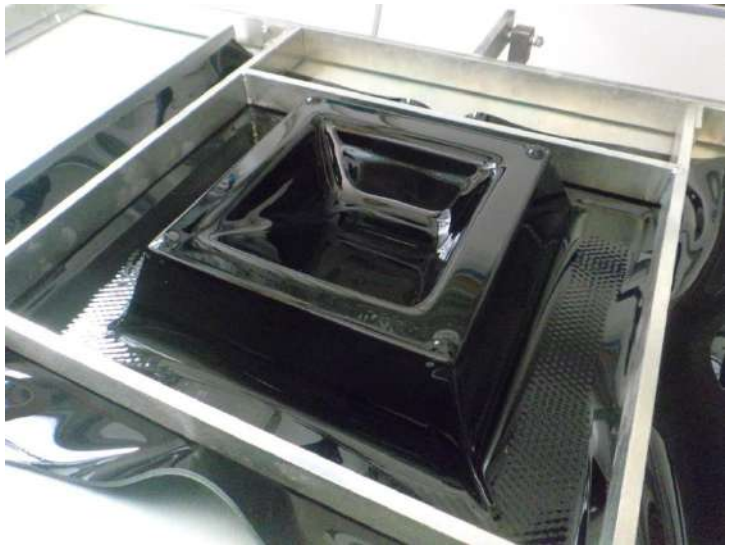
TECHNOFORM S.r.l.

capellini ELECTROSPINDLES



Activities: WP1 – WP2

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CENTRO INTERDIPARTIMENTALE MaM DI RICERCA INDUSTRIALE MECCANICA AVANZATA E MATERIALI

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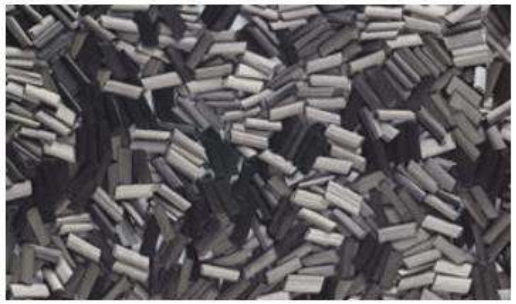
EoL parts

thermal

mechanical

Recycling

rFibres



Pellets

Activities: WP3 – WP4 – WP5

WP5 Process monitoring

Sensors

WP3

WP4

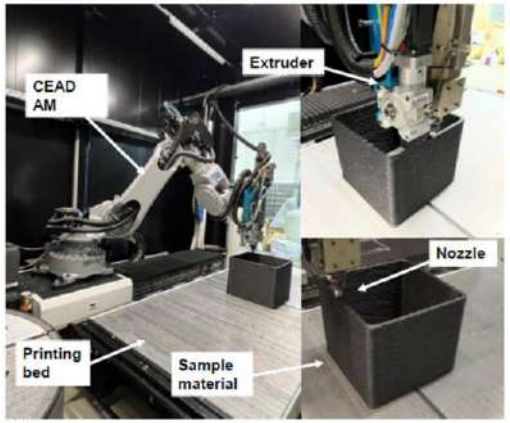
FDM

3D printed part

Machining

Scientifical challenges

The large-scale AM process

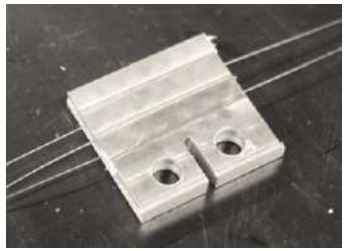


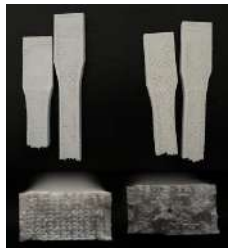
Process Challenges

Automation System	Manufacturing Accuracy	Quality Assurance
• Path planning • Process control • Process monitoring • Automatic cooling •	• Error build-up/mitigation • Thermal management • Process parameters •	• Instability • Accuracy • Contamination • Surface profile • .....

Research theme

Embedded sensing





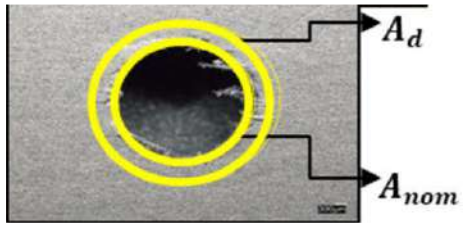
Structural health monitoring

Sustainable machining

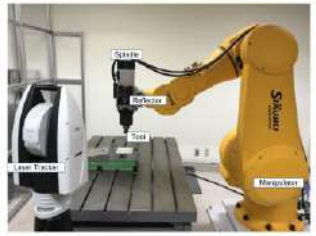
Process Challenges

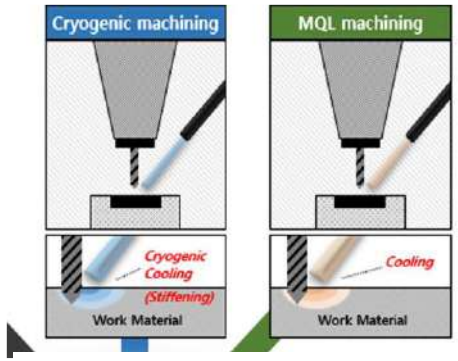
Sustainability of the process

Defects



Robotic Machining





Influence on the machinability

Increased outputs
- Cutting force
- Delamination
- Dimensional accuracy

Decreased outputs
- Surface roughness
- Surface damage
- Fiber fracture
- Tool wear

Increased outputs
- Dimensional accuracy

Decreased outputs
- Cutting temperature
- Damage factor
- Surface roughness
- Surface damage
- Adhesive fiber crack
- Fiber pull-out
- Fiber fill-up
- Tool wear
- MCI damage
- Burr formation

GANTT

RECLAIM-ER: REcyCLe Automotive thermoset for Emilia-Romagna			Estensione temporale																											
			Anno I												Anno II												Anno III					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
WP1	1	Riciclo di materiali compositi termoindurenti da parti a fine vita	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
WP2	2	Sviluppo del materiale termoplastico caricato in fibra riciclata				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
WP3	3	Realizzazione del processo additivo Fused Deposition Modelling (FDM)				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
WP4	4	Lavorabilità del materiale composito CFRP riciclato per asportazione di truciolo							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
WP5	5	Monitoraggio dei processi											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
WP6	6	Casi studio industriali											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

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Grazie per l'attenzione

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