

Identification and critical assessment of circular ecosystems for aerospace composite components based on a novel R6-strategy

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- Problem identification
- Definition of various R-strategies
- Multi-Tiered-System of Recycling (MTS-R) based on six R's
- Identification of circular ecosystems
- Summary



Problem identification



- Demand for composites increased significantly
- Composites are often used in aeronautics industry

***By 2035**, a value of **23.360t/year** of aircraft composite parts is estimated.



- Composite components provide new obstacles for the circular economy since recycling technologies are not sufficiently developed yet

New pathways are required to ensure an effective multiple use of end-of-life components!



Definition of the various R's

- Multi-Tiered-System of Recycling (MTS-R) consists of six different R-strategies:



Repair: "*Repair of a defective product to restore it's original function with oftentimes minimal resource input.*"



Reuse: "Reuse of functional discarded product by another consumer."

Remanufacture: "*Use of a product within a new product to fulfil its original function.*"



Repurpose: "Use of a product in a new product with a different function. These new applications are usually of lower value than the original."



Refurbish: "*Restore an old product to bring it up to date in order to make it useable for a specific application.*"



Recycling: "To process the materials to obtain the same (high grade) or lower (lower grade) quality."

Kupfer, et al, 2022



5 Materials Recycle 🛃 Refurbish Composite waste during manufacturing processes Manufacturing Remanufacture **Operating time** Repurpose Repair 🔪 EOL **EoL composites** data collection SORTING Reuse oby ... based on Conventional "Quality Disposal Methods 🤒 thresholds"



Multi-Tiered-System of Recycling (MTS-R)

Multi-Tiered-System of Recycling (MTS-R): Sorting







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Remanufacture





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Multi-Tiered-System of Recycling (MTS-R): Refurbish





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Multi-Tiered-System of Recycling (MTS-R): Recycle





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Multi-Tiered-System of Recycling (MTS-R)





[https://www.pbisrewards.com/blog/what-is-mtss/]















































Summary



- Multi-Tiered-System of Recycling (MTS-R) aims for waste reduction and energy/emission savings
- Framework consists of: Reuse, Repair, Refurbish, Remanufacture, Repurpose, and Recycling
- Legislative framework is not convincing to encourage such an ecnonmic circularity in Europe
- Identification of the sub-ecosystems: Repair, Reuse and Recycling
- Comprise closed loops, starting with the sorting based on quality thresholds







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