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# TE@CH

additive manufacturing academy  
TO BOOST TRAINERS' COMPETENCES IN INDUSTRY

## Summary

## Selection of Parts



## Course Content

The online course explores an area that requires much further insight and research to push additive manufacturing processes to a higher level, that being materials.



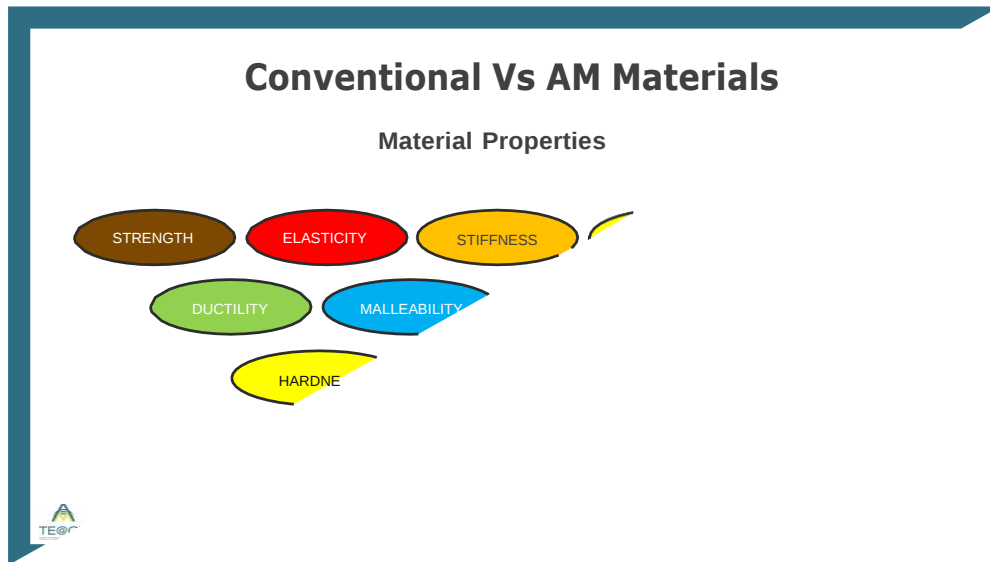
# Conventional Vs AM Materials

## Short Description

One of the most significant advantages of traditional manufacturing, compared to 3D printing, is that it offers a wide range of material selections and the process is also more established. Materials for traditional manufacturing technologies have already undergone years of development in terms of both processing and required product properties. In addition to this solid database of materials, the industry has defined material standards and specifications through globally accepted and used norms. With AM, there is still a gap to close in terms of development, standardization and qualification of materials.

## Conventional versus AM Materials

In processes like machining, the material is a known quantity. A part starts as a billet, or perhaps a forging or casting. Its shape is then changed in the machining process, but its inherent material properties are already set.



## Possible Issues of AM Materials

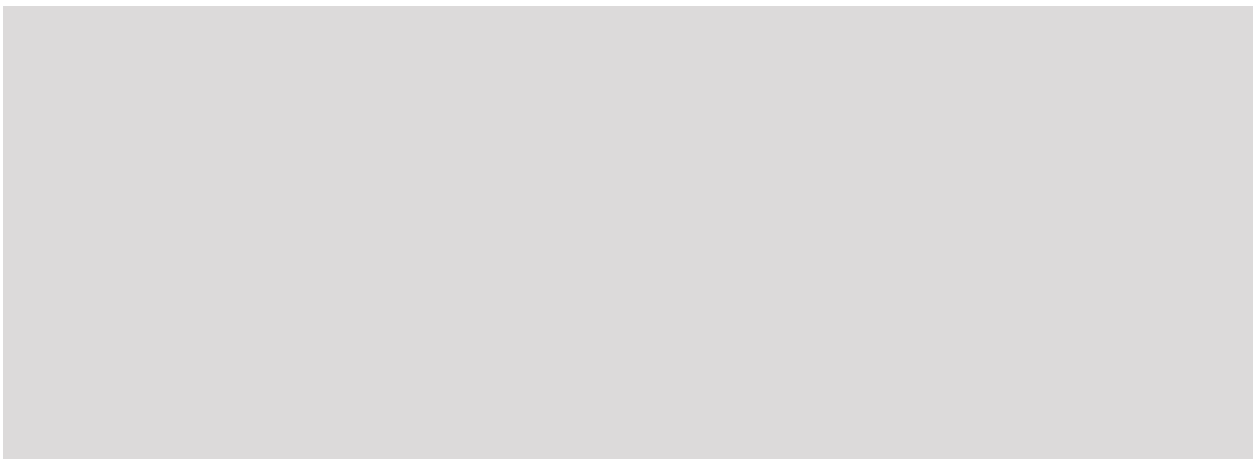
These different materials and AM processes, like other forms of processes, have certain defects that can affect the print quality.

| Possible Issues of AM Materials    |                         |
|------------------------------------|-------------------------|
| Defects                            | Challenges              |
| Balling                            | Anisotropy              |
| Delamination and Deformations      | Microstructural control |
| Crack formations                   | Compositional control   |
| Chemical degradation and oxidation |                         |
| Porosity                           |                         |

The materials development for AM processes is facing challenges including anisotropy, microstructural control, compositional control, as well as others and further research and development are required to move forward at a pace that matches the demand for such processes.

## Notes



## Heat Treatment of AM Parts

Heat treatment can be used to optimize the properties of 3D printed products, adding extra features such as heat resistance or tensile strength.

### Heat Treatment of AM Parts

The tool steel family of powders encompasses the MS1, 1.2709, CX and CM55 alloys. Companies such as "EOS" ensure that all of their AM tool steel powders are shipped with an inspection certificate (according to EN 10204, Type 3.1) showing the results of the extensive Quality Assurance testing, not only of the powder itself but also of test parts built on a dedicated 3D printer with a dedicated process.



EOS Maraging Steel MS1: Courtesy of EOS

These parts show very good mechanical properties being easily heat treatable using a simple thermal age -hardening process to obtain excellent hardness and strength.

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The main goal of heat treatment is to stabilize the metallic microstructure and balance material properties. The types of heat-treat cycles used vary depending on both the alloy and fabrication method, but all of them play an important role.

## AM in the Circular Economy

Additive manufacturing is also seen as a powerful enabler of circular economy, which aims at reducing resource consumption while boosting business opportunities. No waste production and reduced physical inventories are just few examples of how AM could positively contribute to CE goal.

### AM in Circular Economy

- Reducing the use of materials in the first place
- Reusing or remanufacturing products and parts
- Creating durable products that deliver value for longer





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Additive Manufacturing can help aid and accelerate the Circular Economy. A circular economy links material, design, manufacturing, product and end-of-life in a continuous, sustainable loop and 3D printing has roles to play in every step.

## Notes



For further information please

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