

Metodi di progettazione per lo stampaggio a iniezione di plastica riciclata da post consumo

Prof. Giovanni Lucchetta

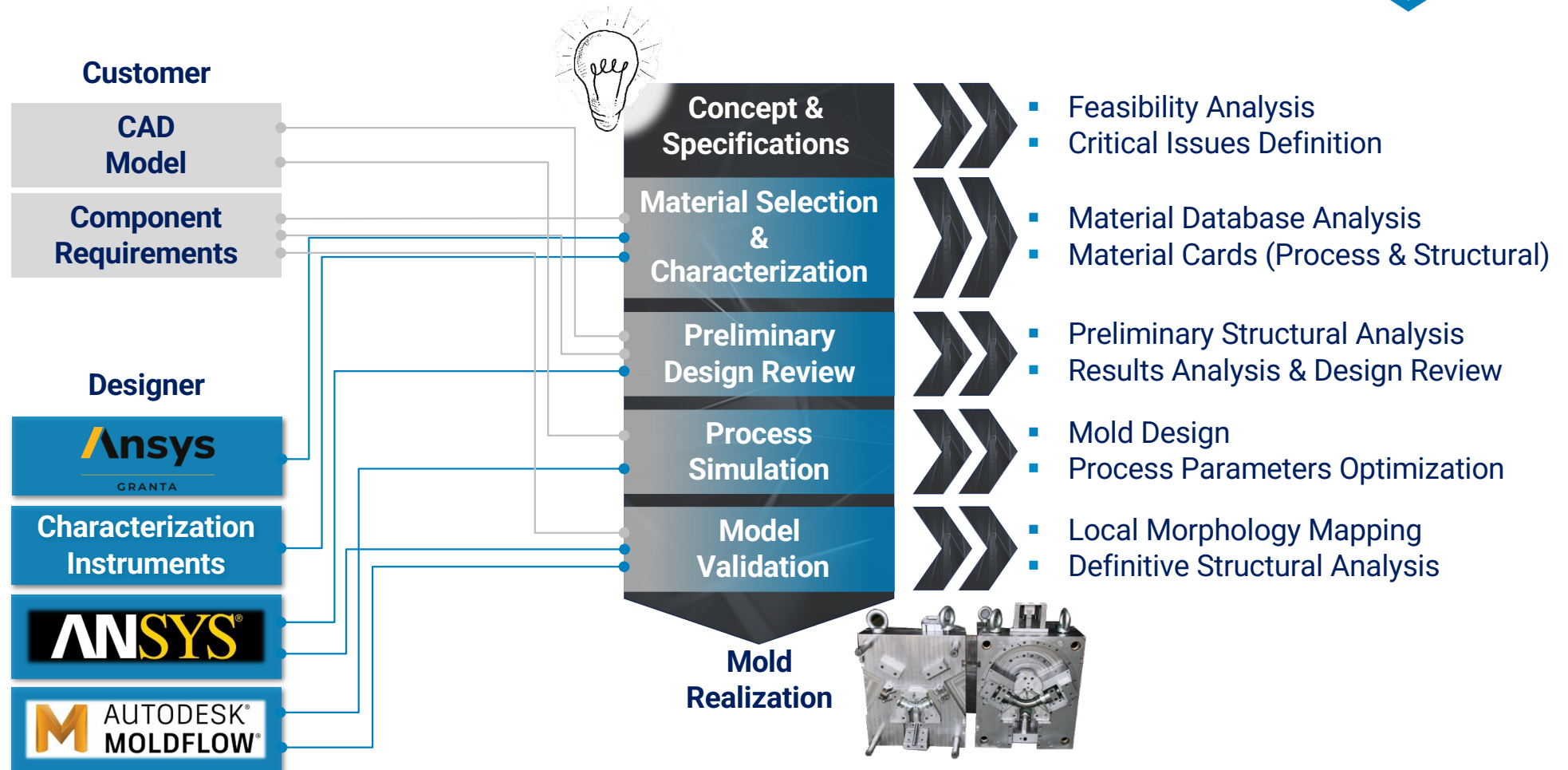
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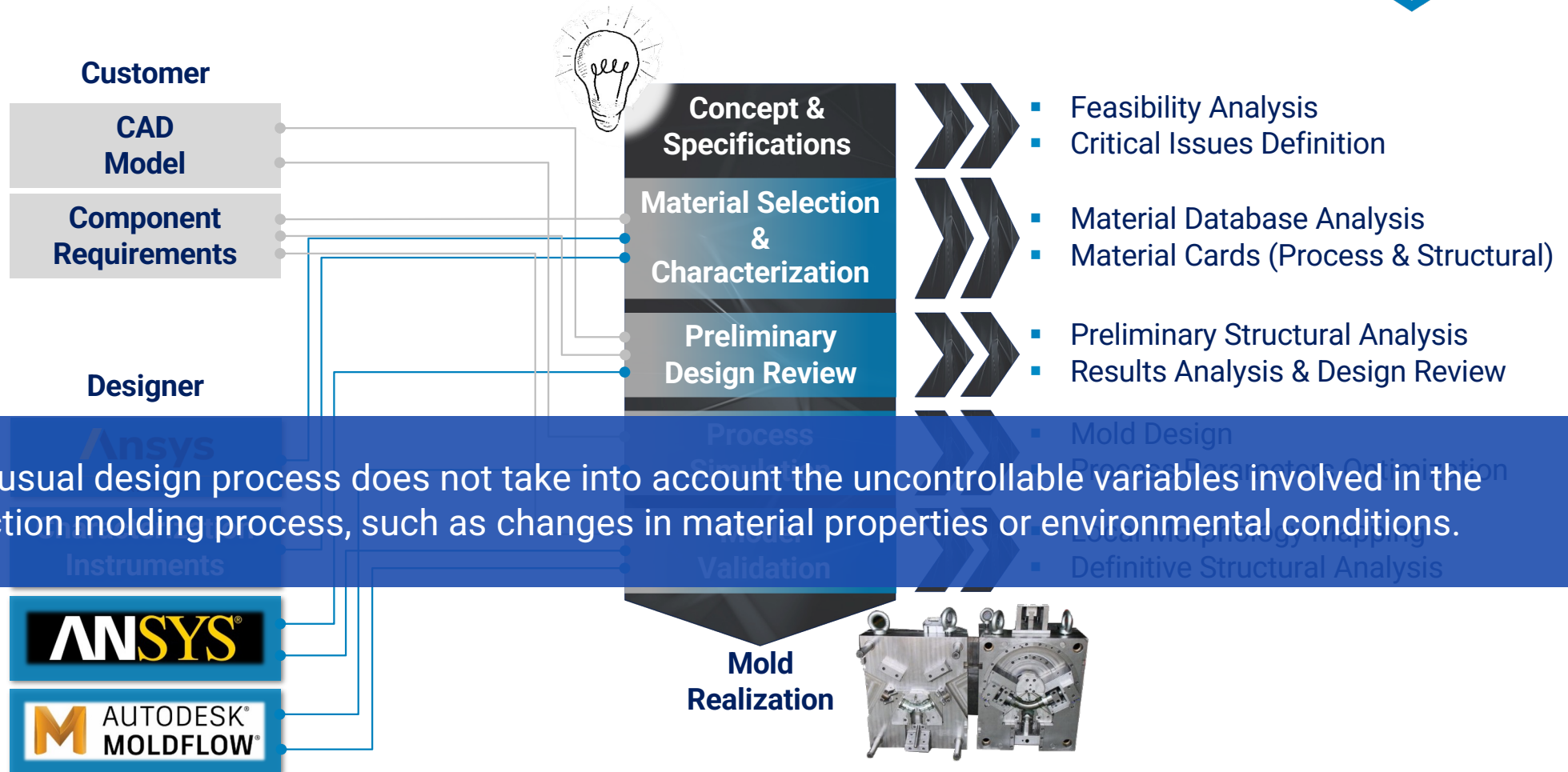
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Design of a plastic part

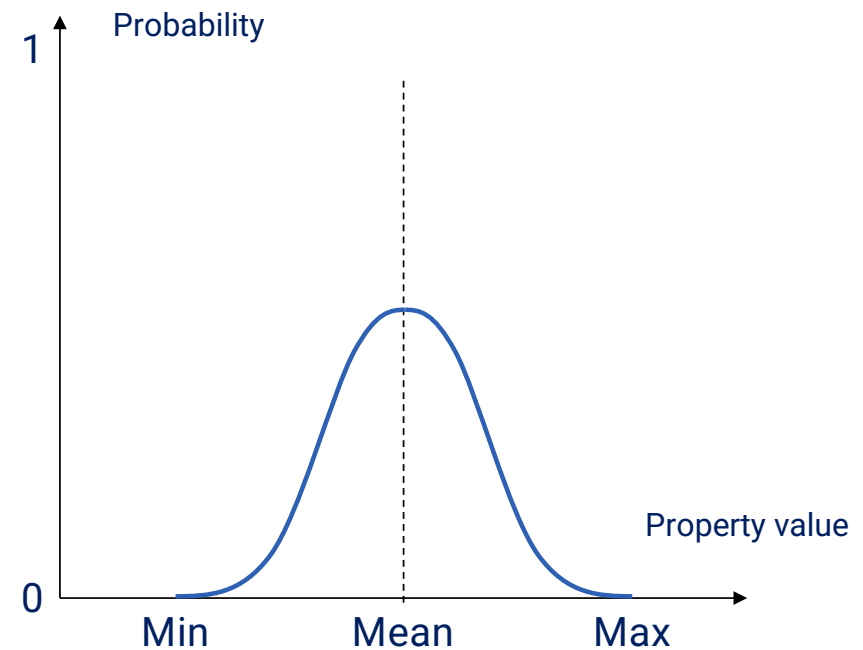


Design of a plastic part

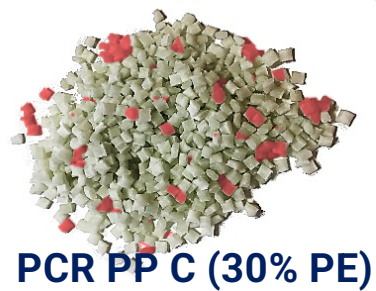
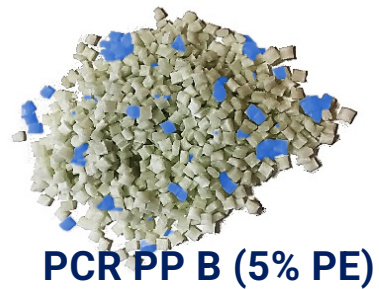
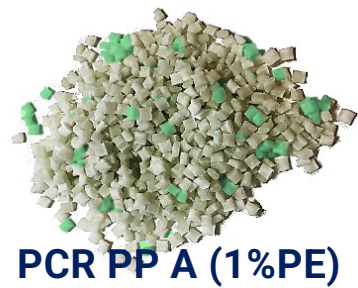


Post-consumer recycled plastics have variable properties

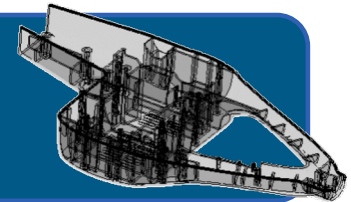
- When injection molding compounds containing post-consumer recycled plastics, material properties such as viscosity and elastic modulus may be **uncertain**.
- Input properties are then defined not by a deterministic value but as a **distribution** (each value has a statistical probability to occur).



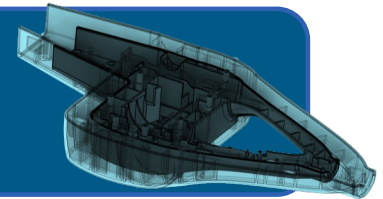
Properties variations in a post-consumer recycled PP



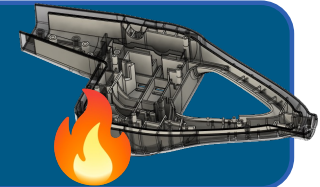
Viscosity



Crystallinity



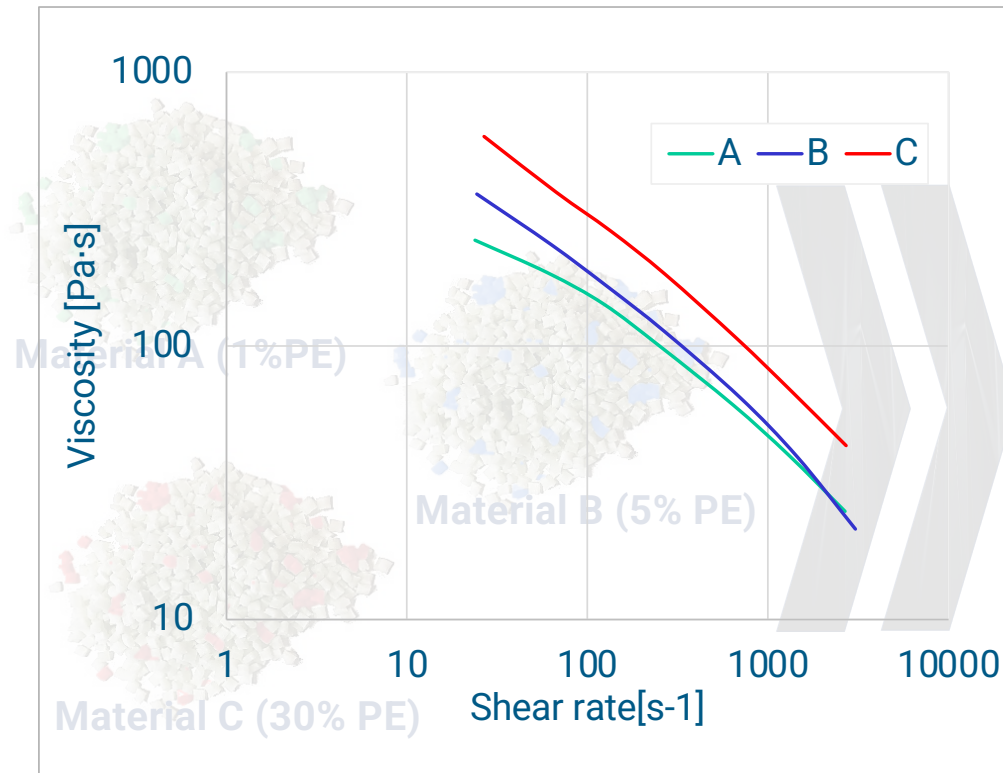
CLTE



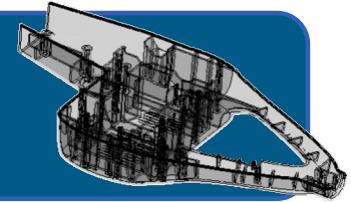
Mechanical



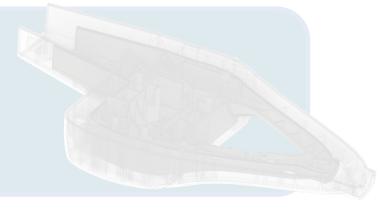
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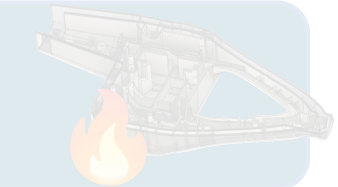
Viscosity



Crystallinity



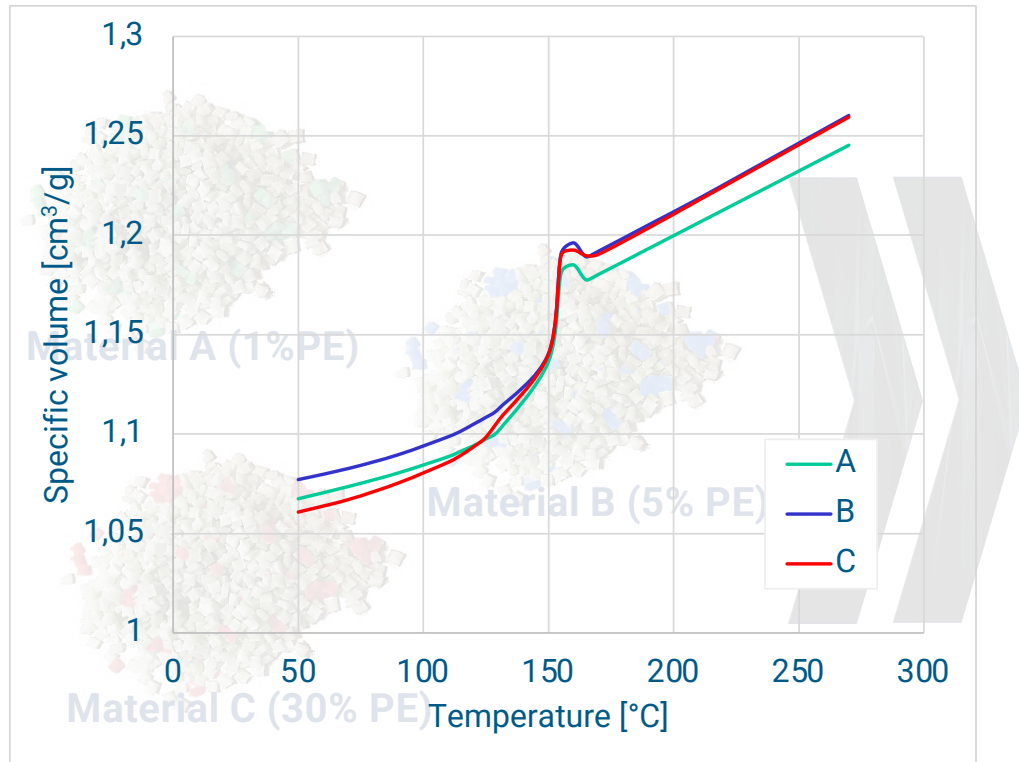
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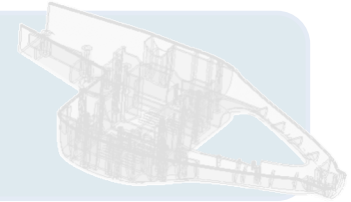
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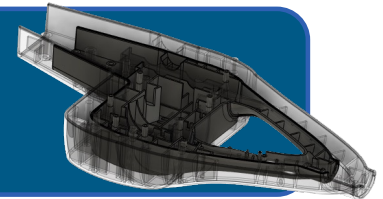
Properties variations in a post-consumer recycled PP



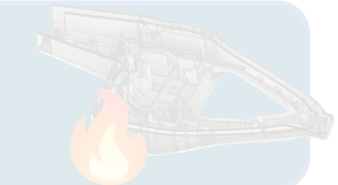
Viscosity



Crystallinity



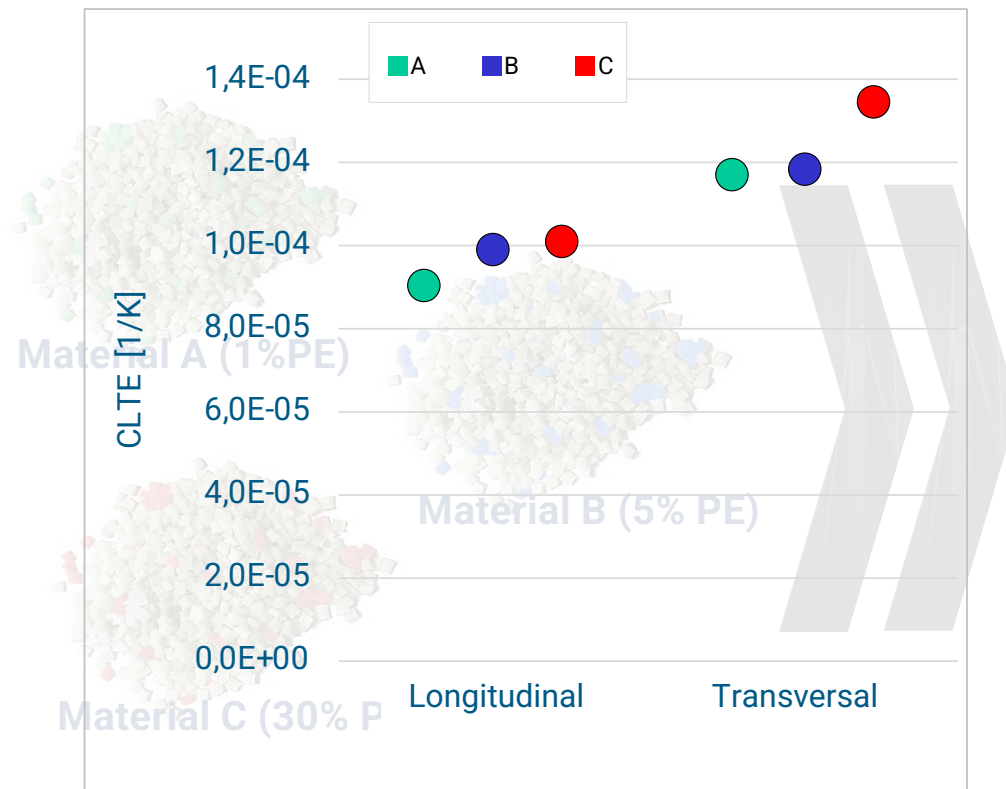
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Mechanical



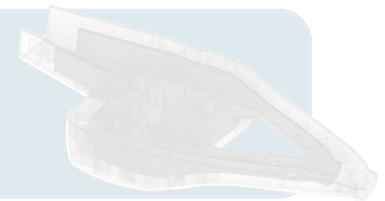
Properties variations in a post-consumer recycled PP



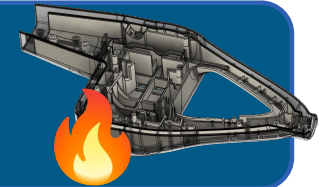
Viscosity



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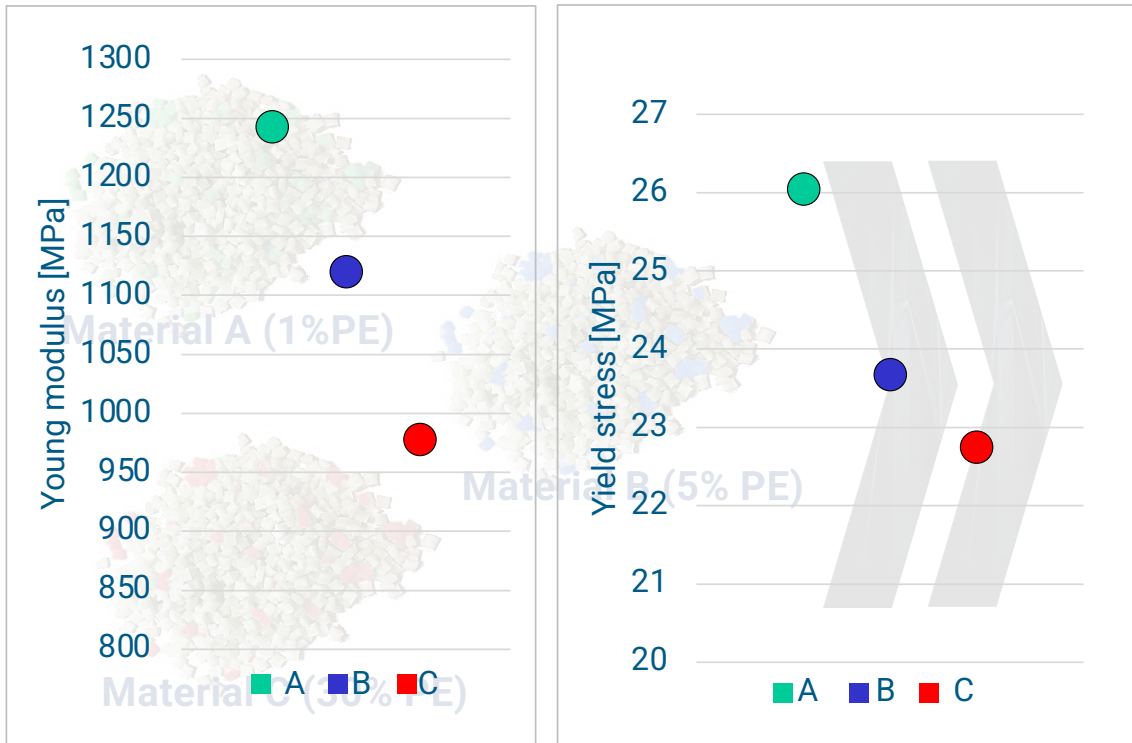
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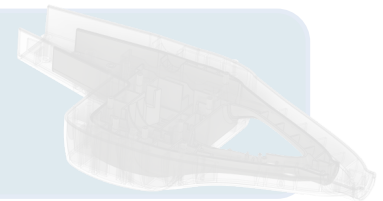
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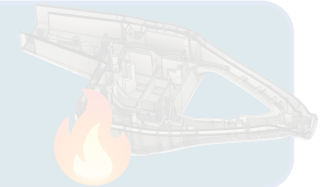
Viscosity



Crystallinity



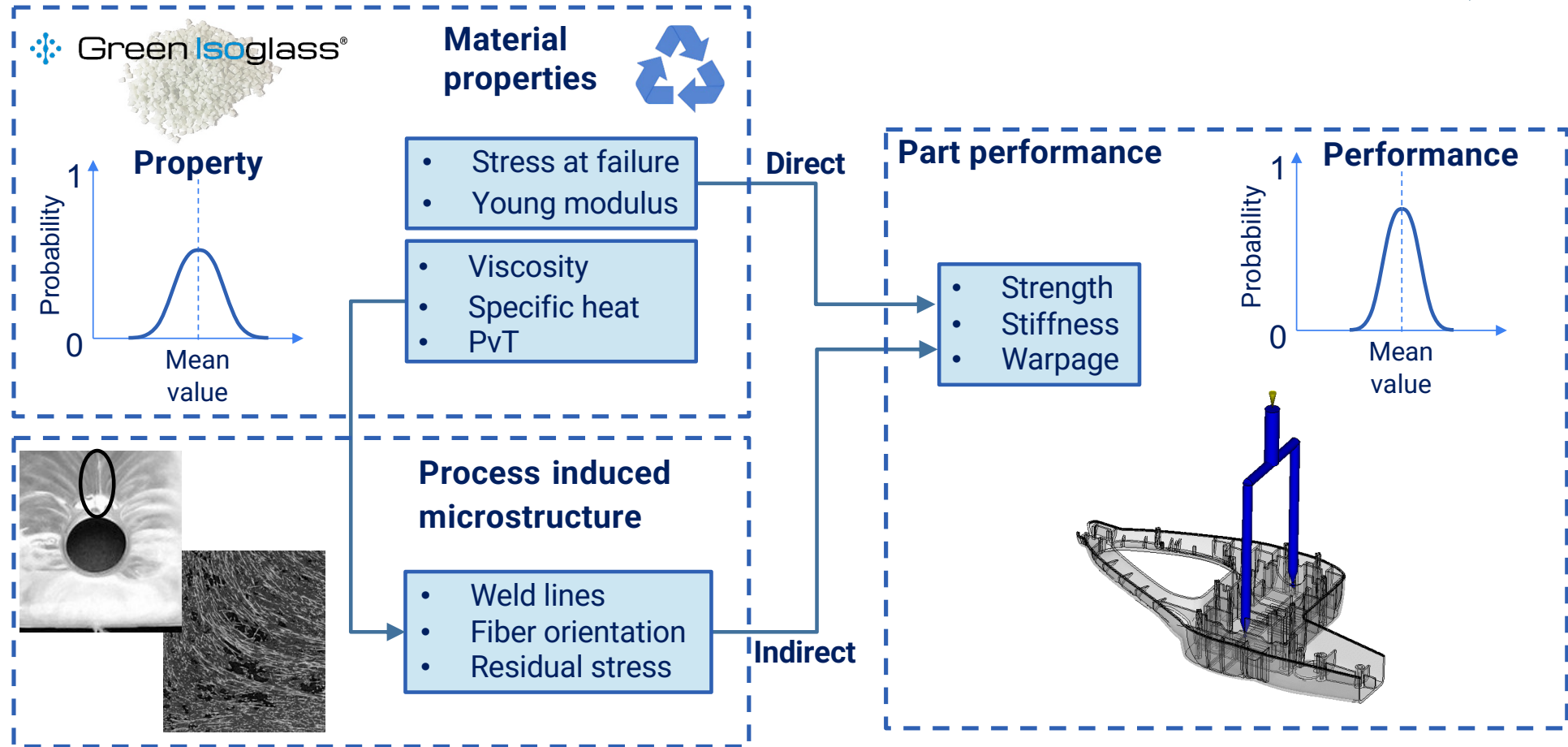
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Mechanical



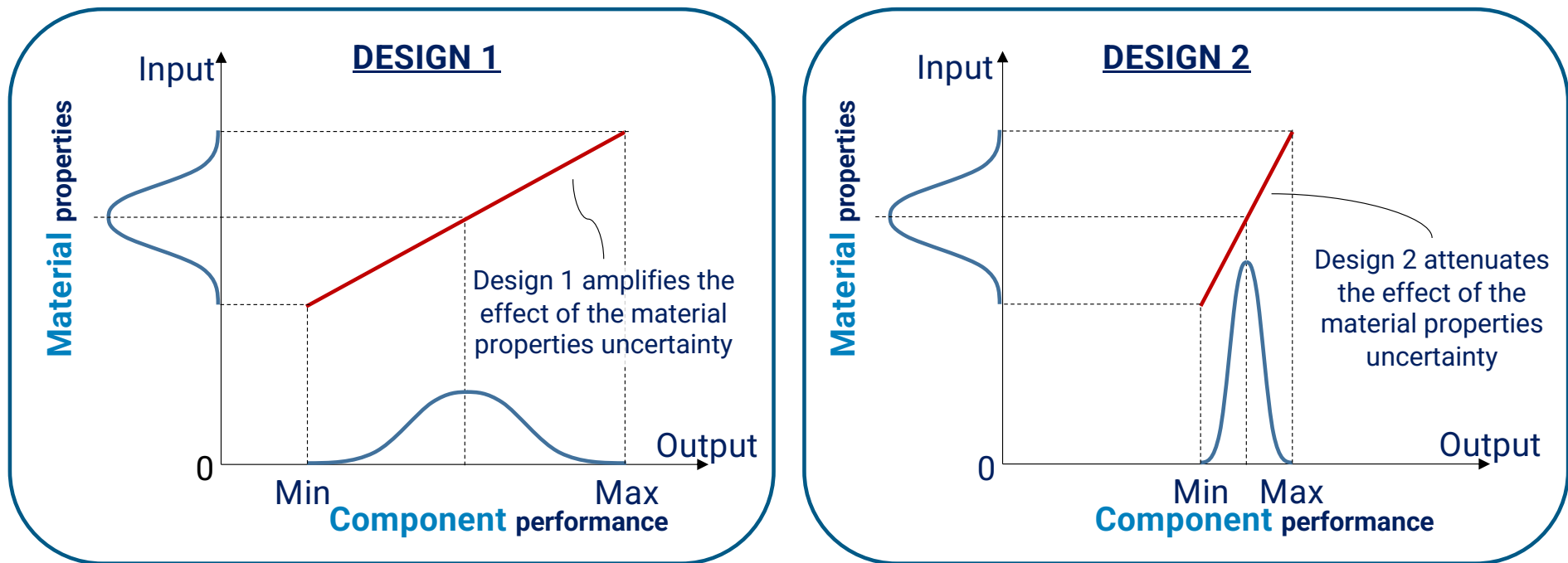
How much do these properties variations affect a product quality?



Robust design: how to make the design insensitive to properties variations

The material properties uncertainty is **reflected in the outputs** of the injection molding process e.g. in terms of strength, stiffness and warpage variations.

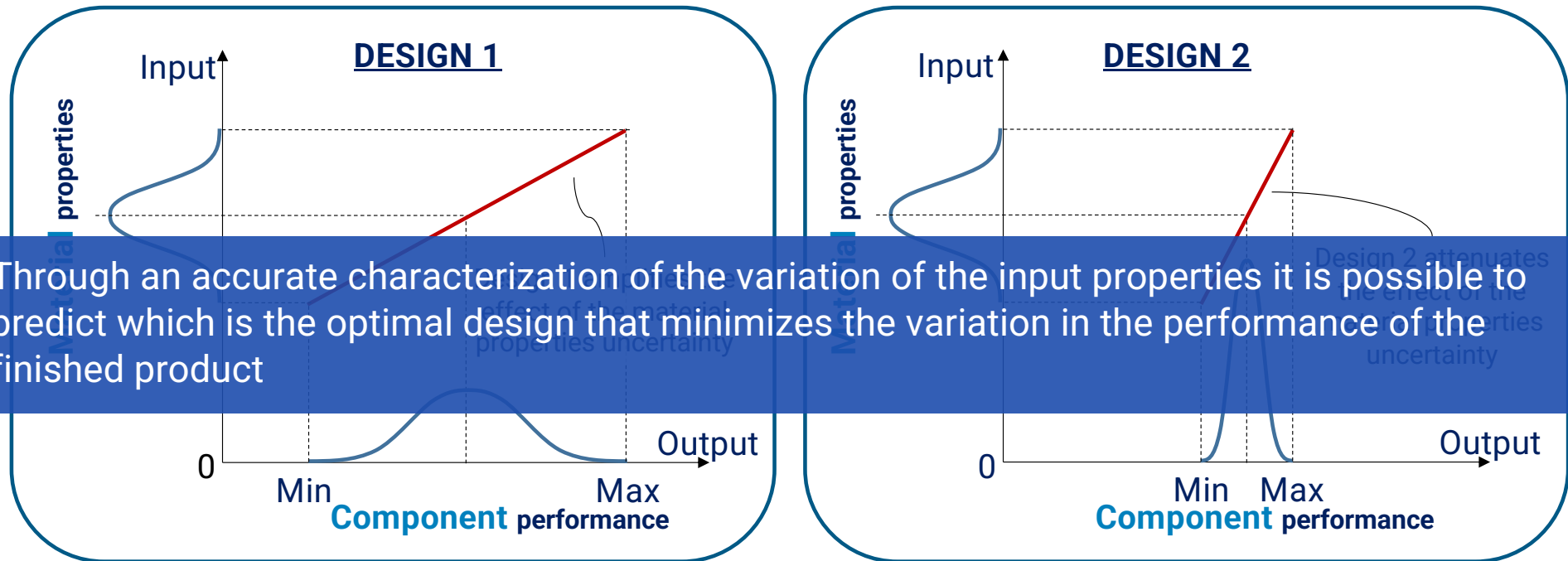
The **robustness of the design** is defined as its ability to be **insensitive to the variation** of the material properties.



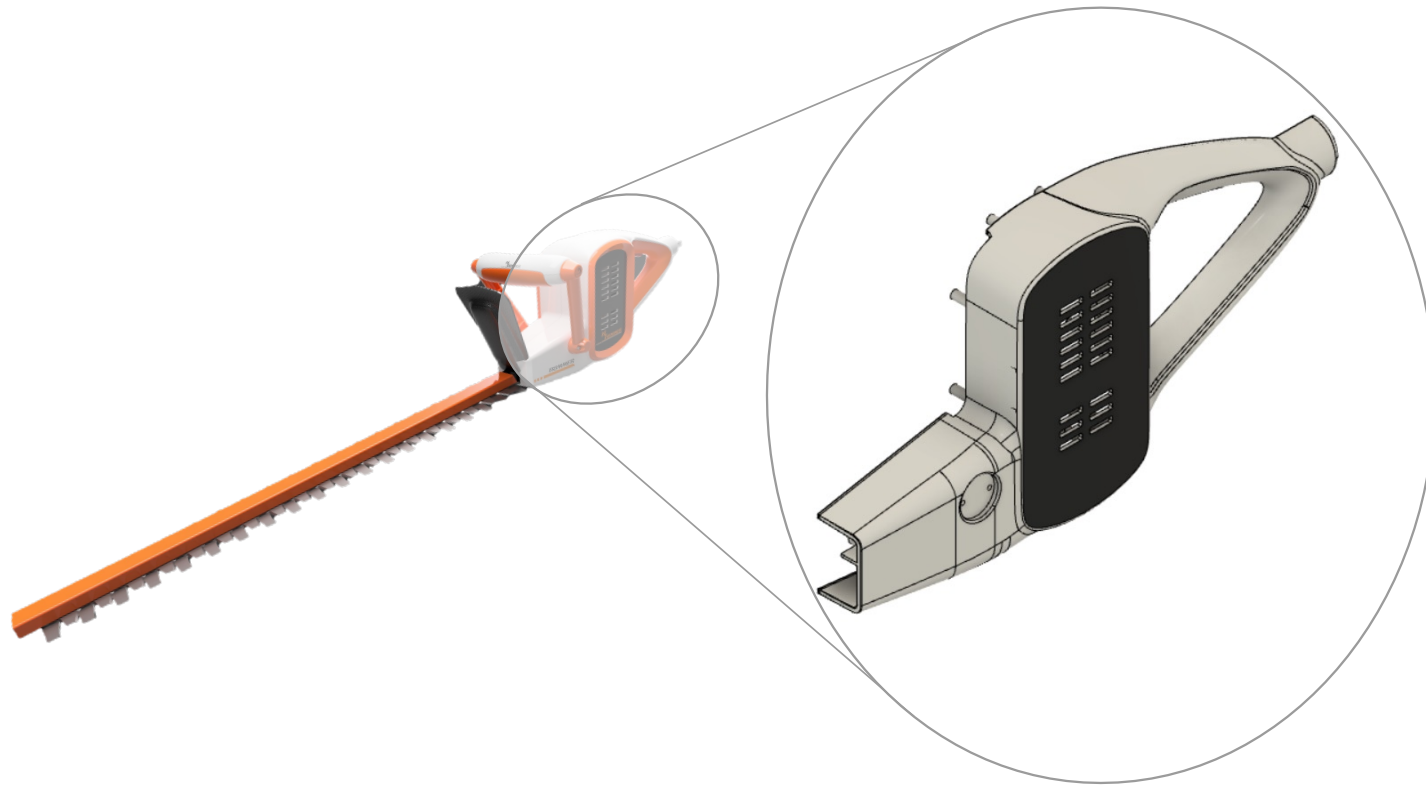
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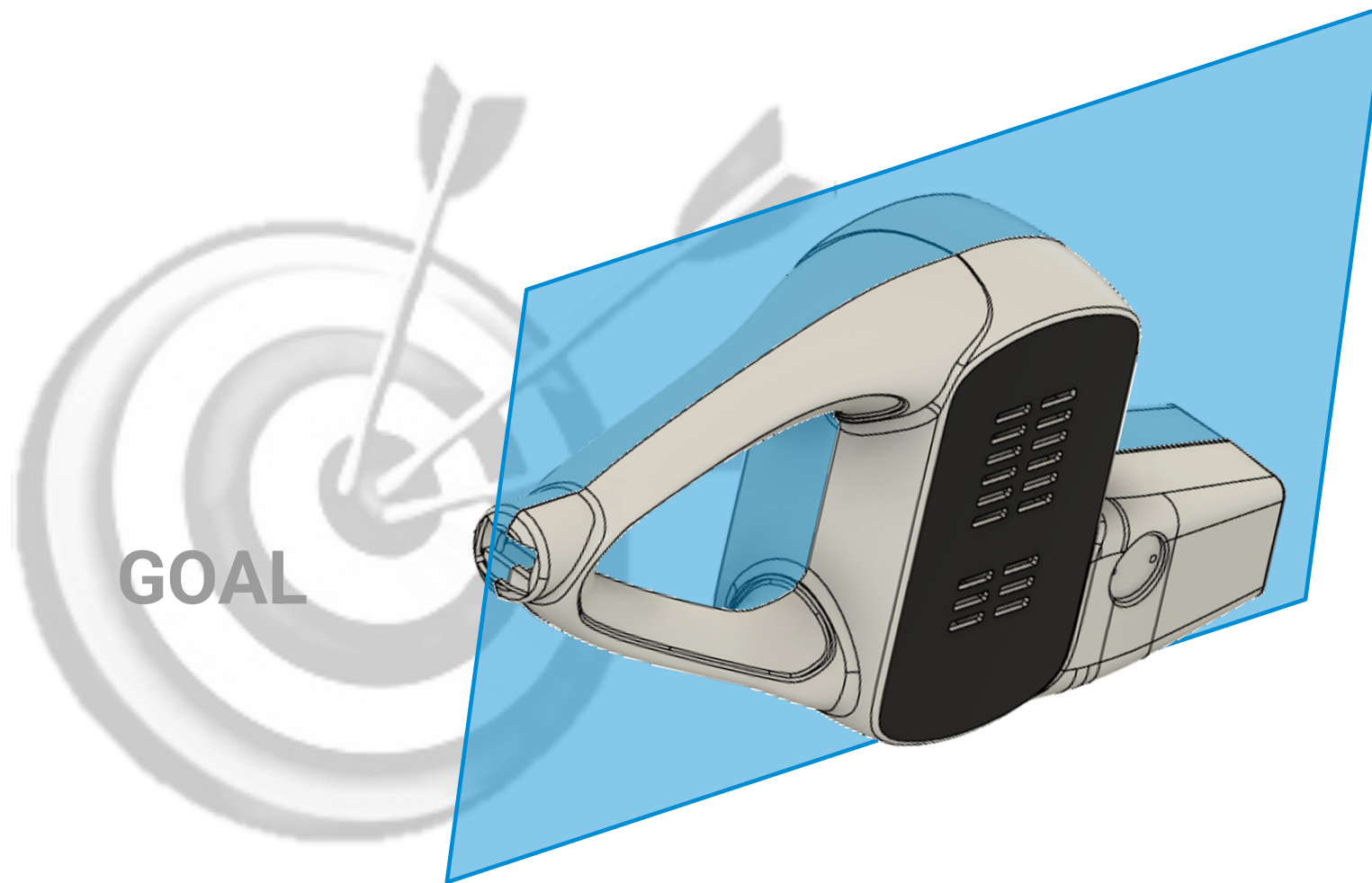
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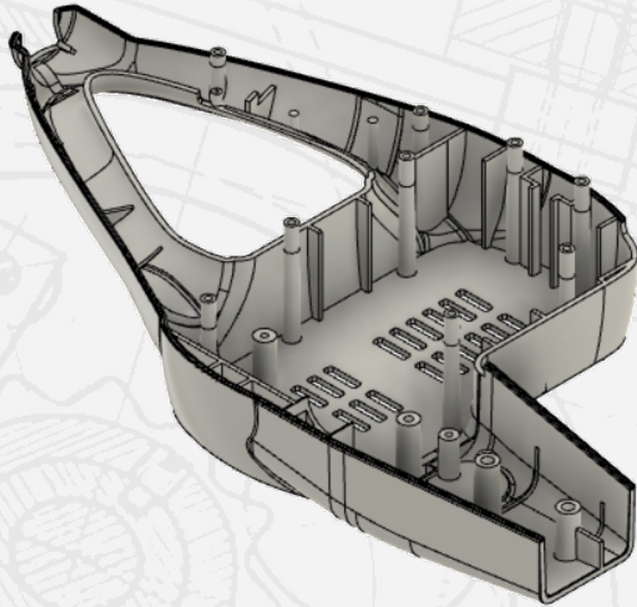
Robust design example



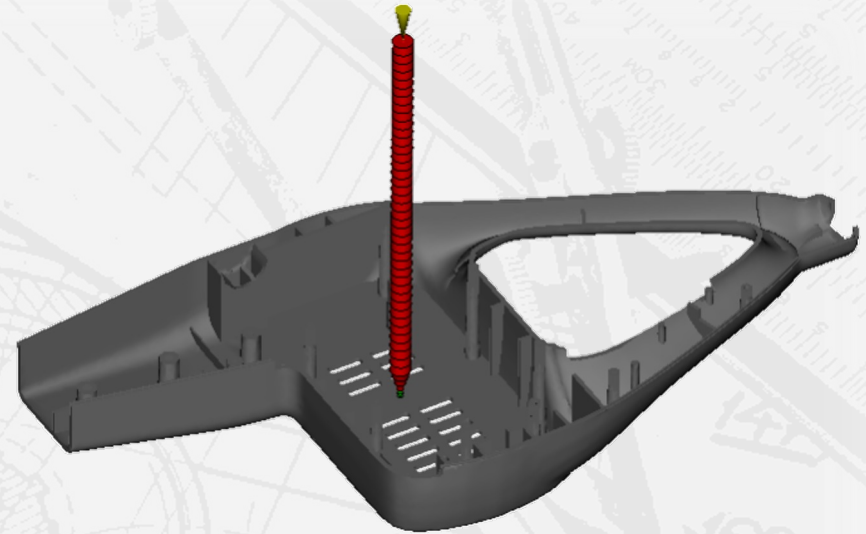
Robust design example



Original design

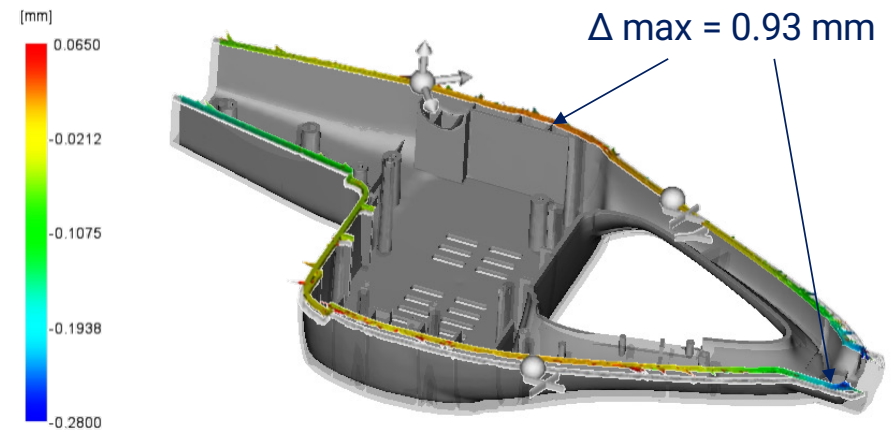
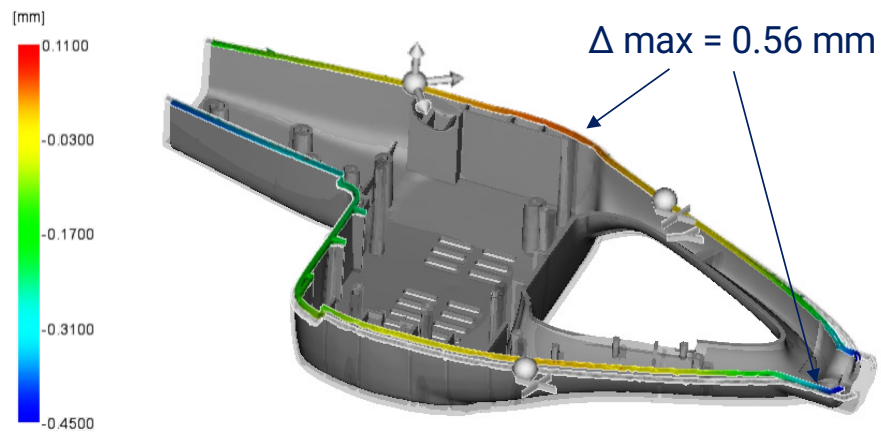
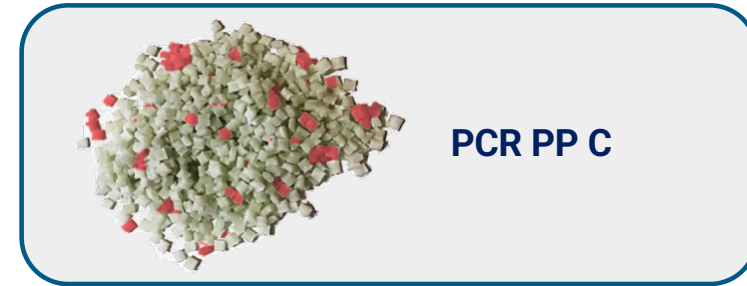
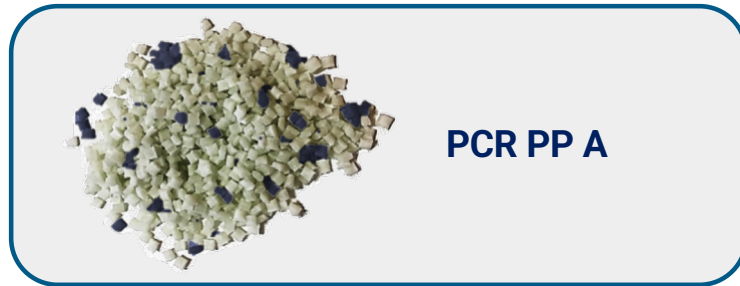


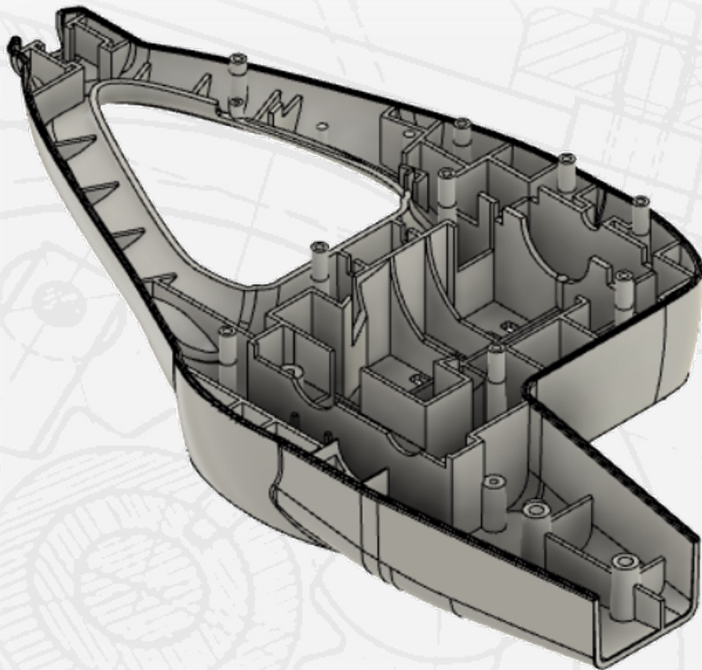
Original part design



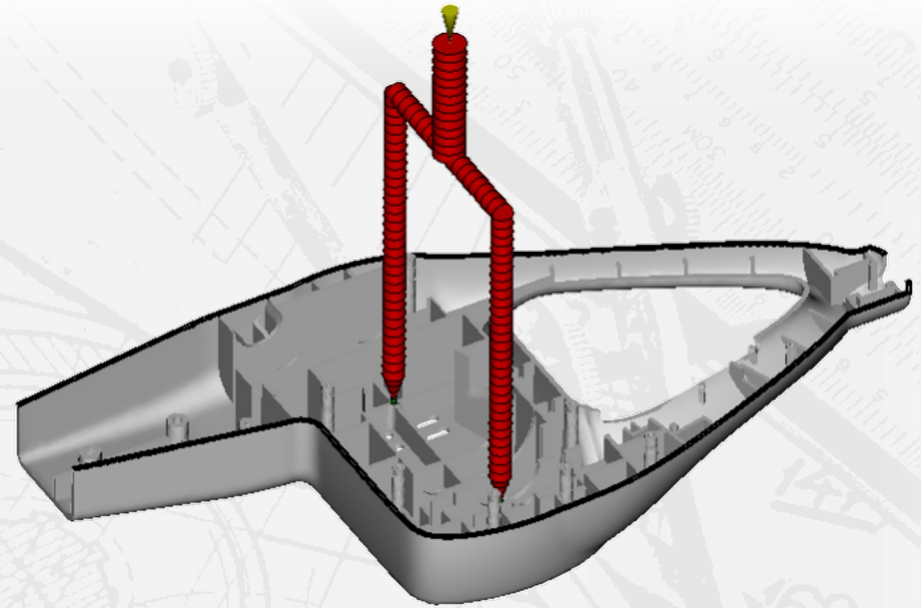
Original mold design

Original design: influence of properties variations



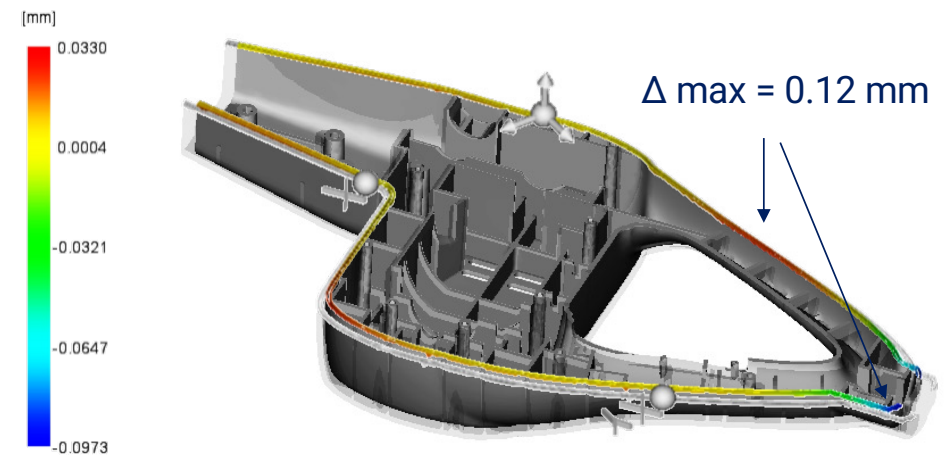
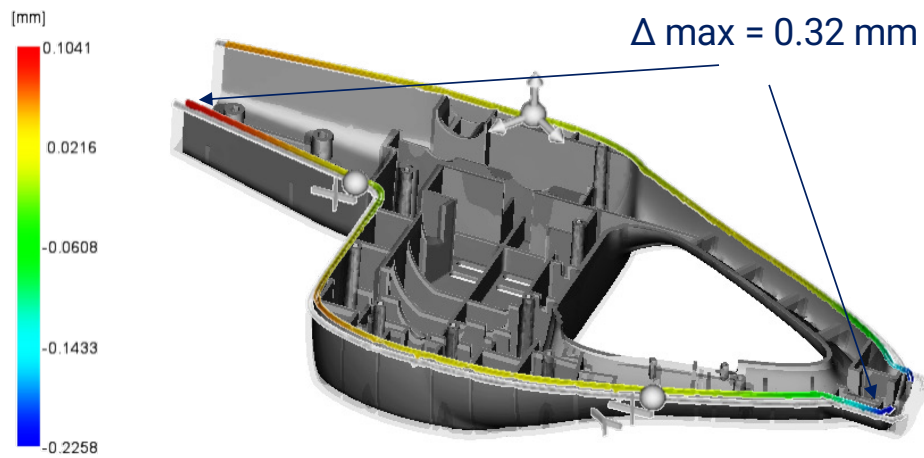
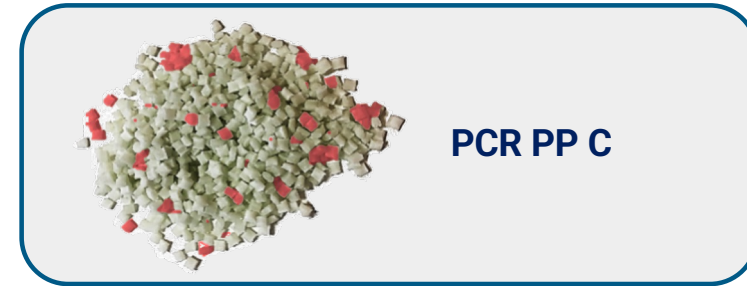
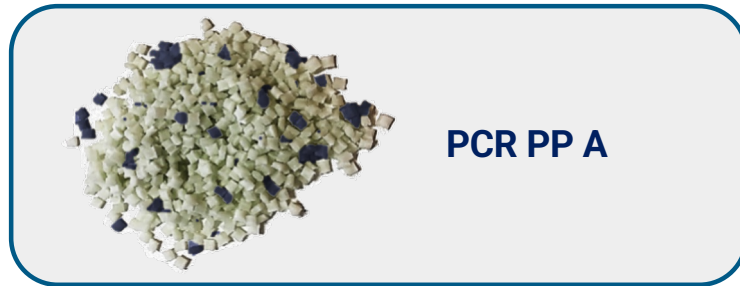


Robust part design



Robust mold design

Robust design: influence of properties variations



- The **Robust design** method allows to obtain a component capable of being **less sensitive** to input variations.
- The achievement of the optimal design takes place through an analysis of the variation of the inputs and an iterative process: this allows to **avoid oversizing** and **excessive costs**
- In this analysis it has been shown that through a robust design of component and mold it is possible to **reduce the variation of the outputs** (up to 80%) in conditions of **instability** of the material properties.

GRAZIE

«Thanks»

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