3D printed prototype with selective metallisation as a validation approach in product development of the automotive sector

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Introduction

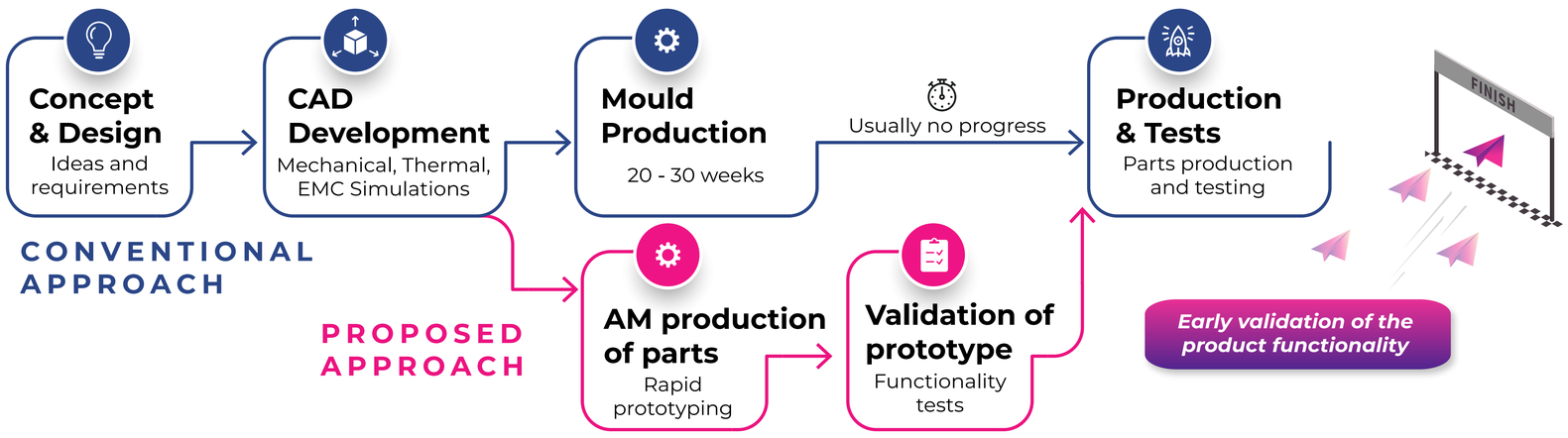
Industry and consumers are constantly pushing the requirements of their products to new levels.
Enormous challenges in terms of shape, materials and processes demand the constraints for product developers, some as:

• **Weight is costly:** Industry requires the development of lightweight products. Also, less material = lower emissions.

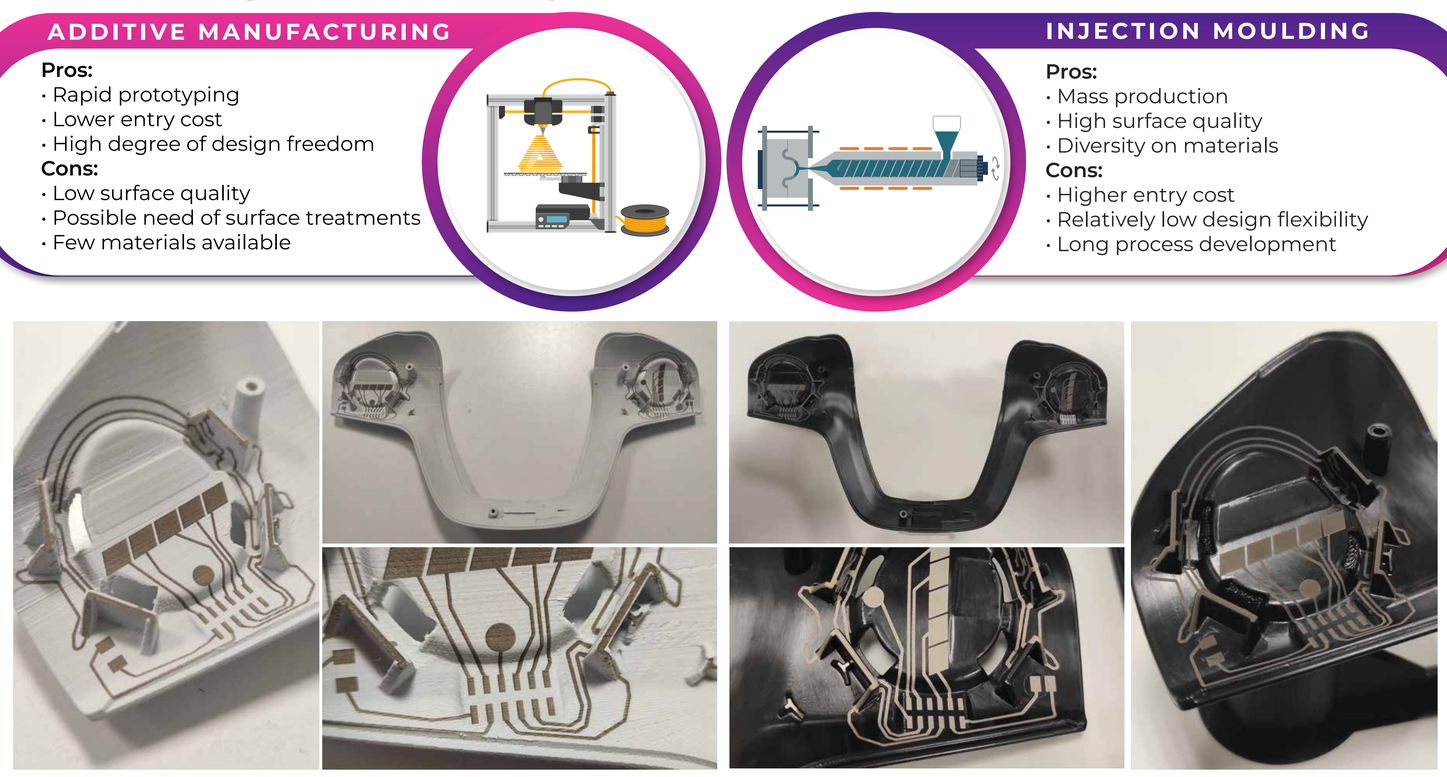
• **More than just decorative:** Design and create multifuncional products. Integrate electronic circuits and sensors into plastic surfaces.

• **Time to market:** Long time to develop the mould when using the Injection Moulding (IM) technology = long time to validate the product functionality.

The proposal



Processing of the polymeric part



The case study

A polymeric part from a steering wheel, which had only decorative functions, was selected to be functionalised in this project.

The main objectives are:
• Integration of electronic circuits through LDS technology;
• Incorporation of capacitive buttons;
• Haptic response.

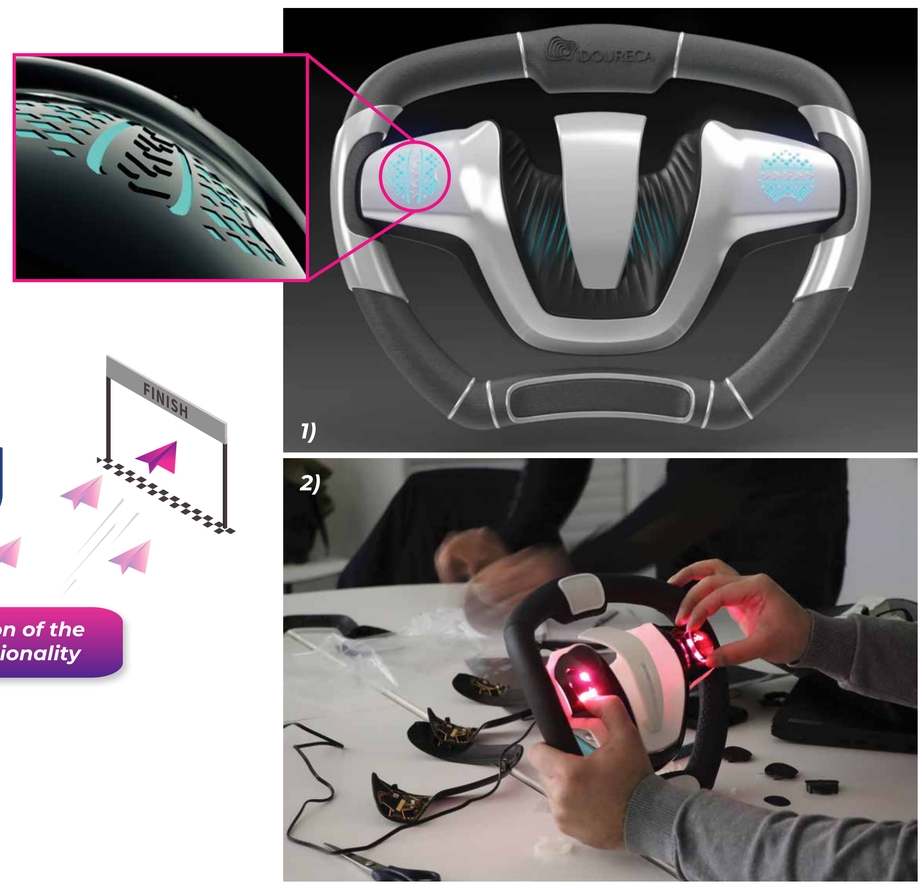


Fig. 1. Steering wheel:
1) Concept and 2) Prototype

LDS technology

Laser Direct Structuring technology allows the implementation of electronic circuits directly into plastic surfaces.

Fig. 2. Steps of LDS technology:
1) The part is produced based on a modified material;
2) laser irradiation marks the desired circuit;
3) copper and other metals are deposited during the electroless bath; and
4) the components are assembled to the piece.

Challenges

• **Surface rugosity:** Parts produced by AM have a higher surface rugosity in comparison to IM parts. In order to improve the quality of the metallisation, surface treatments should be used.

• **Positioning:** AM parts have less mechanical stability in comparison to IM parts = precise structuring is challenging.

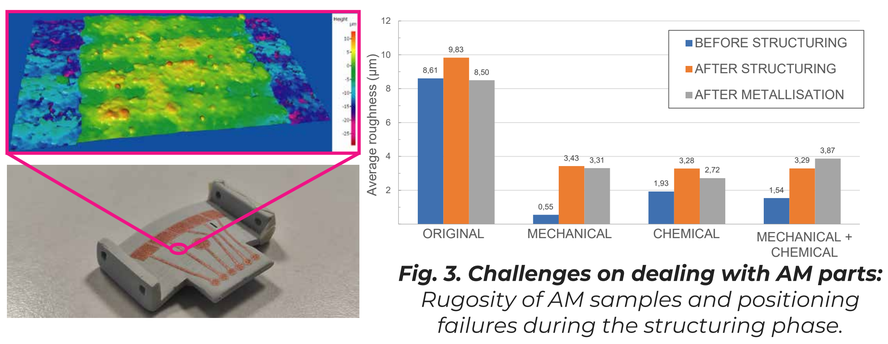


Fig. 3. Challenges on dealing with AM parts:
Rugosity of AM samples and positioning failures during the structuring phase.

Conclusions

• The freedom of shape and other benefits from AM can be explored in product development to validate innovative and multifunctional parts in an early stage, saving time and reducing costs.

• For mass production, as the required by the automotive industry, IM continues to be the state-of-the-art, so hybrid approaches like this are complementary and not substitutive.

• Special attention must be taken regarding the rugosity of AM parts as it has influence on the metallisation of LDS process. It was verified that AM parts require specific surface treatments for effective metallisation of circuits.

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