Aesthetical automotive component with a fully embedded de-icing and anti-icing system

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ABSTRACT

Over the last years, global urban transportation has been experiencing a significant growth due to the introduction of autonomous vehicles in the market. Currently, the operation of these vehicles exploits sensing technologies to detect the presence of vehicles, objects, and pedestrians in their vicinity. Nonetheless, the performance of these sensing systems is highly influenced by critical environmental conditions, such as presence of rain, snow and/or fog, which can therefore hinder their correct operation. By aiming to the future of automotive vehicles, iDOURECA project intends to overcome the impact that environmental conditions can impose to the specific operation of RADAR sensors. As a result, the development of automotive components with fully embedded functionalities is proposed, being these particularly focused on the mitigation and/or elimination of ice layers that can accumulate in the respective components' surface, and that could otherwise stand in the sensors' reading path, compromising the correct operation of the RADAR sensor.

OVERVIEW

DEFINED CONCEPTS FOR THE FUTURE CAR

SHARED ELECTRIC AUTONOMOUS CONNECTED UPDATED

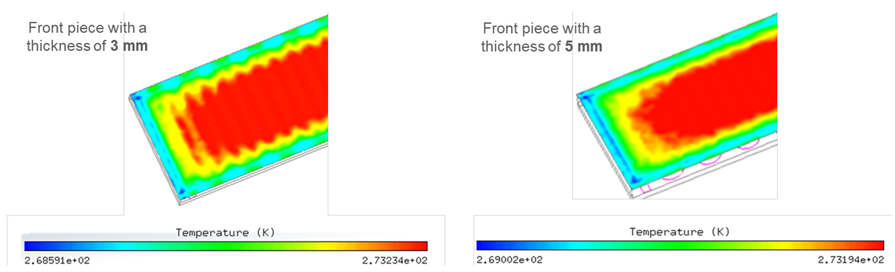
MAIN GOALS

New manufacturing methods must be designed or readjusted to incorporate novel technologies and functionalities in the vehicle body, without compromising its aesthetics and weight, in order to:

- Improve the user's comfort and experience while driving;
- Conjugate smart functionalities with aesthetical features.

NUMERICAL SIMULATION

For the same heater design, the temperatures registered at the surface of the component are similar for both thicknesses, although the temperature mapping reveals that a higher distribution of heat is achievable with a lower thickness. Nevertheless, **the temperatures are rather low**, suggesting that the formation of ice is still possible, which should be **more focused on the borders of the piece**, due to the lowest temperatures registered at these locations.



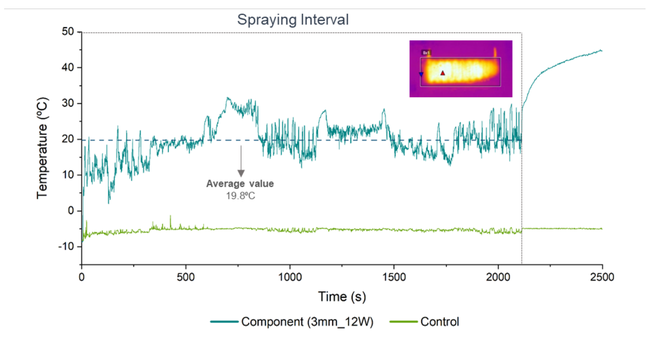
METHODOLOGY

Screen printing of heating systems onto polymeric substrates, using conductive inks. Printed systems were then evaluated regarding their **electrical resistance**

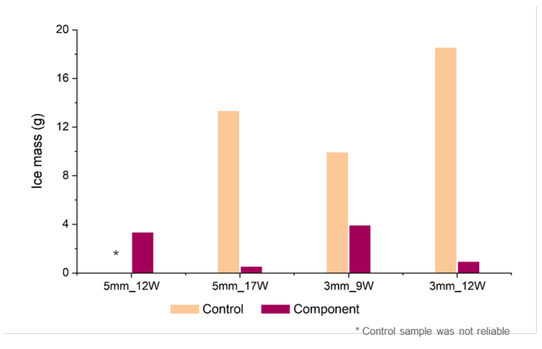
The heating systems were sandwiched between two polymeric pieces, with the front one having **different thicknesses** (5 mm and 3 mm).

In order to evaluate the performance of the produced pieces under critical conditions, these were characterized in a climatic chamber at **-10 ºC** and **85%** of relative humidity. To simulate the presence of rain, the samples were **sprayed with water** for 30 minutes.

EXPERIMENTAL RESULTS



For each thickness of the upper piece, **the heating system was tested under different values of electrical power**, being the temperature on the surface of the component and the control piece registered by thermal imaging.



A **substantially lower ice mass was measured when compared to the control** piece, demonstrating the efficiency of the heating system during anti-icing operation. In the component, the accumulated ice was mostly focused on the borders, whereas at the surface covered by the heating system the sprayed water maintained its liquid form.

FINAL REMARKS

The characterization methodology was defined and validated.

The performance of the heating systems will be further evaluated in the components **fully produced by forming processes**.

From preliminary tests, the printed films exhibited a **high mechanical resistance** to the injection molding process conditions, with its electrical resistance maintaining the expected values.

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