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SMART INDUSTRIES

Smart Automotive Soft Skin

SETTING THE SCENE

With the ongoing electrification of cars, the design of the automotive interior is set for significant change. Currently, the trend is to incorporate an increasing number of displays. But next will come the integration of what is known as SHY-TECH technology (as initially introduced by BMW). SHY-TECH technology remains discreetly hidden from view, no longer diverting our attention but rather discreetly assisting the driver. Instead of conspicuous displays, SHY-TECH technology will be integrated into the decorative surfaces, revealing functions only when necessary. This approach will simplify the user experience, reducing complexity and driver distraction.

A critical consideration in this evolution is the weight of components, hence the use of printed electronics. Presently, printed electronics are primarily used with rigid thermoplastic materials using non-stretchable substances. However, medium and high-end cars often feature extensive surfaces covered with various types of artificial leather that are flexible. Adapting printed electronics for these flexible materials presents a challenging research endeavor.

To tackle this topic and develop an innovative technology platform for automotive interior components, we set up this project SASS, bringing together a number of highly experienced industrial partners and research institutes.

FRAMING THE RESEARCH OBJECTIVE

In the project, the following research objectives were addressed:

- Exploring new technological combinations involving (T) PU substrates and conductive inks, as well as assembly processes for electronic components that are compatible with integration into spray-coated polyurethane layers (< 2 mm). In this exploration, we took into account the stringent specifications for functionality, aesthetics, and reliability requirements for automotive applications.
- Resolving the conflict between the need to integrate light elements behind dark PU layers (demanding a very high optical efficiency to ensure satisfactory visibility of luminous elements in both high and low ambient light conditions) and the requirement of making components beneath the PU surface inconspicuous when in the off state.
- Defining the optical criteria necessary to achieve a good contrast, uniformity, and brightness across various ambient light conditions.
- Ensuring that these new technologies meet the rigorous reliability requirements of the automotive industry while remaining compatible with cost-effective roll-to-roll (R2R) production.

THREE MAIN OUTCOMES

Looking back on the SASS project, these have been the major accomplishments and the differentiators with potential competing technology:

We have developed innovative processes for integrating electronic circuitry onto soft substrates. These are compatible with processes to embed and integrate light and touch functionality. Reliability tests have given us insights in failure mechanisms and have led to valuable insights into suitable material combinations, designs, and process windows. As a result of these efforts, we successfully created a number of functional demonstrators.

Second, the project partners have gained valuable insights regarding the development of translucent materials. This includes a comprehensive analysis of light transmission effects in function of color loading and thickness. Also, the light transmission measurements revealed the color shifts when light passes through the colored skin of materials. In that respect, we experimented with the introduction of minor amounts of color pigments to allow for some control over this color shift. Because our intent was to create fully polyurethane (PU) components, we introduced chemical modifications into the PU material to create a transparent PU system suitable for use as a light guide material.

Based on our PU systems, we developed models for light transmission. These provide valuable insights into the impact of light guide design on light output, the achievable efficiency of light output, and the potential for crosstalk between adjacent areas. Furthermore, these models have improved our understanding of how signs and symbols will appear on the surface of the materials. This has helped us to determine the minimum lighting requirements for making signals and buttons visible.

With the incorporation of grain texture in combination with variations in light transmission levels, SASS introduces a novel and attractive feature in decorative and ambient lighting surfaces, adding an element of innovation to the field. Our approach has proven to be highly effective, surpassing many commercial solutions. We have successfully achieved light transmission levels of 10%, setting a benchmark for competitor materials.

NEXT STEPS

SASS' project outcomes will prove a valuable basis for further research. The know-how on printing and assembly processes on soft substrates will be used in follow-up projects related to wearables, heaters, e-textiles... Moreover, the integration methods for electronics in PU skins will be used to integrate printed heaters in PU surfaces, a growing application in automotive interiors for electric vehicles.

MM-WAVES project partners:

CMST · KU LEUVEN · QUAD industries · ascorium INDUSTRIES · CONNECT GROUP INTEGRATED SUBCONTRACTORS

AGENTSCHAP INNOVEREN & ONDERNEMEN · Vlaanderen is ondernemen

The MM-WAVES project was co-funded by imec, with project support from Agentschap Innoveren & Ondernemen

As for commercialization plans, the project partner Ascorium is promoting the potential of its translucent material in several demonstrators, foremost as surface material for ambient backlighting. In addition, a potential commercial project for translucent material for automotive applications is under discussion.

FACTS

NAME	**SASS**
OBJECTIVE	Integration of printed electronics functionalities in soft materials for automotive applications
TECHNOLOGIES USED	printed electronics, SHY-TECH, automotive, light modeling
TYPE	imec.icon project
DURATION	01/10/2020 – 31/03/2023
PROJECT LEAD	Yvan Vanluchene, Ascorium Belgium NV
RESEARCH LEAD	Frederick Bossuyt, imec - CMST
BUDGET	1.964.833,23 euro
PROJECT PARTNERS	Quad Industries, Connect Group, and Ascorium Belgium NV
RESEARCH GROUPS	ESAT – TELEMIC – KU Leuven
RESEARCH GROUPS	imec – CMST – UGent

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WHAT IS AN

IMEC.ICON PROJECT?

The imec.icon research program equals demand-driven, cooperative research. The driving force behind imec.icon projects are multidisciplinary teams of imec researchers, industry partners and/or social-profit organizations. Together, they lay the foundation of digital solutions which find their way into the product portfolios of the participating partners.

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