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PRESS RELEASE
October 30, 2017

Paper for RFID tags industrial printing

July 12, 2017, Victor Thénot defended his doctoral thesis at University Grenoble Alpes prepared under the supervision of Nadège Reverdy-Bruas, Associate Professor, of Denis Curtil, Research Engineer (Grenoble INP-Pagora / LGP2) and the co-supervision of Mohamed Saadaoui, Associate Professor (École des Mines, Saint-Étienne). He presented the results of his research work entitled *Printing and selective sintering of metal based inks on paper. Optimization of electrical properties of RFID-HF loops for industrial production.*

This work examines the potential of a very smooth paper for the mass production of printed RFID-RF tags. Characterizations on PowerCoat HD paper demonstrate high temperature tolerance and verv low roughness. lt thus represents a serious alternative to the use of polymeric films (PET, PEN, Pl, etc.) enabling the electrical performance of metallic conductive inks to be fully developed.

Two industrial printing processes have been considered: flexography and screen printing, and their use was discussed for the printing of low-cost electronic devices. Moreover, the electrical performances of commercial silver based inks are studied according to the size of their particles. lndeed, the use of metal particles at the nanometric scale can facilitate the activation of the atomic diffusion mechanisms, thus improving the physical contact between the particles and promoting electrical conduction. ln parallel, microparticles inks are cheaper and their conditions of use less restrictive. In any case, the coalescence of the metal particles after printing cannot be initiated without a thermal sinter ing treatment.

Sintering is usually carried out in an oven or hot air tunnel; the temperature must therefore remain below the tolerance of the substrate. This leads to limited electrical performances for long process duration of several minutes. ln order to take into account the industrial constraints of largescale production and to achieve the best electrical performance in a short time, one of the main explored research areas is the deployment of emerging near- infrared (NIR) and intense pulsed light (IPL) photonic technologies. These latter are based on the absorption of light energy by the ink film thus

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causing rapid heating. The important absorption differential between the inks and the substrate allows high heating selectivity which makes it possible to limit the degradation of the substrate while the ink temperatures may be greater than 300°C. For each sintering process, the influence of the various parameters on the final electrical performance has been studied by using an *in situ* resistance monitoring, allowing sampling frequency up to 250 kHz.

Finally, RFID-HF loops were printed, sintered under previously optimized conditions and then characterized. An estimate of the production costs was carried out in order to distinguish the contributions related to the ink, the substrate and the silicon chip. The obtained results demonstrate the potential of PowerCoat HD paper, coupled with flexographic roll-to-roll printing and near-infrared technology, enabling the large-scale production of RFID-HF tags at a material cost of the order of 5 euros cents.

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