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PRESS RELEASE
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Material transfers in conductive inkjet printing

December 5th, 2017, Vincent Faure defended his doctoral thesis at University Grenoble Alpes prepared under the supervision of Anne Blayo, Teacher-researcher (Grenoble INP-Pagora / LGP2), and of Yahya Rharbi, CNRS Researcher (Laboratoire Rhéologie et Procédés, Grenoble) and the co-supervision of Aurore Denneulin, Associate Professor (Grenoble INP-Pagora / LGP2). He presented the results of his research work entitled ***Controle of conducting partern formation by inkjet printing: multi-scale control of material transfer in nanometric suspensions*.**

This thesis focuses on the understanding of the mechanisms involved in the inkjet printing of silver nanoparticles-based inks in order to optimize the manufacturing of thin (width <100 µm) conductive tracks with high and homogeneous performances. Inkjet printing can be divided into several phases: the ejection of picovolumetric droplets, the impact on the substrate, the spreading and the drying. The drying phase is a complex phase prone to particle migration phenomena such as coffee ring effect. This phenomenon, due to the capillary flow which implies a movement from the center to the edges of the drop, drives most of the suspended particles towards the edges of the printed patterns.

The aim of this work is to describe precisely and understand the mechanisms which operate and lead to the transfer effects in order to limit or even eliminate them and guarantee the production of performing and homogenous fine conductive lines. To achieve this objective, three paths of investigation were developed.

A first axis deals with the study of the different phases of the droplet generation process. Parameters impacting the dried droplet morphology are identified and optimized with a focus

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on substrate temperature. Four geometrical indexes are designed to characterize quantitatively the dried droplet profile homogeneity.

A second axis specifically studies the drying phase of picovolumetric droplet in order to understand the phenomena occurring during this phase. A modelling of droplet drying is set up in order to understand the forces influencing the matter transport.

Finally, a last axis studies the print of thin conductive lines composed of several printed droplets partially superimposed. Correlations between line morphology, droplet morphology and electrical conductivity are established in order to produce optimized systems.

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