



Congratulations to New ICFO PhD graduate

Dr. Mehmet Alican Noyan graduated with a thesis in "Self-Cleaning Optical Surfaces for the Inkjet and 3D Printing Industry"

June 23, 2017

Dr. Mehmet Alican Noyan received his Bachelor's degree in Metallurgical and Materials Engineering from ODTU and Master's degree in Materials Science and Nanotechnology from Bilkent University in Ankara, Turkey, before joining the Optoelectronics research group led by ICREA Prof. at ICFO Valerio Pruneri. At ICFO, he centered his doctoral work in studying the properties of transparent surfaces at the nano-scale in order to investigate new methods and designs that could help reduce ink aerosol and powder contamination on these surfaces. Dr. Mehmet Alican Noyan's thesis, entitled "Self-Cleaning Optical Surfaces for the Inkjet and 3D Printing Industry" has been supervised by Prof. Dr. Valerio Pruneri.

Abstract:

Liquid and solid repellent surfaces are key to many industries. For example, construction industry benefits from self-cleaning windows, cements, paints, roof tiles, and corrosion resistant surfaces, while easy-to-clean, antifingerprint and antibacterial surfaces are highly relevant for display applications.

In inkjet and 3D printers, the unwanted deposition on the inner parts of raw materials in the form of liquid, aerosol or solid particulates may cause device malfunctioning. In particular, ink aerosol and powder may obstruct light passage in several key components, such as sensors and lamps. To address this, the thesis proposes and investigates novel designs and methods to reduce ink aerosol and powder contamination on transparent surfaces.

In the first part, Joule heating and hydrophobicity against ink aerosol contamination are studied. The former effect is provided by a transparent conducting film (TCF), while the latter through a self-assembled monolayer (SAM) coating. The combination of the two effects reduce transmittance loss from an average of 10% to less than 1.5% in the presence of ink aerosol. Correspondingly, the area of the surface covered by ink decreases from around 45% to less than 2%. Results obtained with the glass substrates are subsequently extended to the plastic window of a commercial inkjet printer calibration sensor. Furthermore, effectiveness of the proposed self-cleaning surfaces inside an inkjet printer is demonstrated.

In the second part, a technology called "electric curtain" is used to design a self-cleaning surface against powder contamination in 3D printers. Powders are the starting material for forming the objects and are largely present inside the printer. It is shown that an electric curtain can clean about 50% of the powder that deposits on the surface. The thesis also proposes a new electric curtain design consisting of a double electrode layer which significantly increases the particle removal efficacy to more than 70%, with plenty of margin

of improvement.

In summary, in this thesis novel self-cleaning transparent surfaces are proposed and their potential for inkjet and 3D printing industry is demonstrated in real operating conditions.

Thesis Committee

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