Laboratoire Lasers Plasmas et Procédés Photoniques– UMR 7341

PhD thesis:

Amorphization of silicon surfaces using ultrafast lasers for microelectronics applications

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Monthly allowance: ~1725 €/month (net)
Duration: 36 months
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Description: Contact silicides are critical building blocks of microcroelectronics devices as they are commonly used to provide electrical contacts between transistors and copper interconnects. Today, ultrathin silicides layers (between 10 and 20 nm) are required and they are obtained thanks to a pre-Amorphization process using ion Implantation (PAI) of silicon surfaces prior to the reactive metal deposition. Given the influence of the amorphous layer properties on the silicidation, a better control over the pre-amorphization process is highly desirable.
In the frame of a multi-partner ANR Project, the PhD candidate will investigate experimentally laser-based treatments for the advent of an efficient process alternative holding promises to meet the requirements for this highly demanding application. In particular, amorphization of silicon can be obtained by ultrafast quenching following ultrashort (fs). Several important questions will treated to identify the best interaction conditions for the desired materials response and the optimum precision. In particular, the dependence on the laser wavelength (NIR-VIS-UV) and pulse duration will be troughfully investigated in regard to the precision limits. The PhD candidate will also work on the development of on optical diagnostic for insitu monitoring the synthesis of the ultrathin amorphous lyers (typ. 50nm and less) and performing PoC process demonstrations before contributing to some technology demonstrations with strong interactions with the industrial partner for this project (ST Microelectronics).

Reference: M. García-Lechuga, N. Casquero, A. Wang, D. Grojo, J. Siegel, Deep silicon amorphization induced by femtosecond laser pulses up to the mid-infrared, Advanced Optical Materials 9 (2021) 2100400