Laboratoire Lasers, Plasmas
et Procédés Photoniques – UMR 7341

MSc. thesis:

Inducing and probing ultrafast laser induced amorphization of silicon

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Conditions: Flexible starting date, ~6 months, ~630/month (net)
Keywords: ultrafast physics, ultrashort laser pulse, phase-change, silicon, semiconductors

Description: In this work, the Master student will develop a pump-and-probe reflectivity setup to investigate the melting and solidification dynamics in crystalline silicon upon deep-UV femtosecond laser irradiation. This spectral domain has been recently identified as highly beneficial for the direct formation of amorphous layers attractive for new applications in microelectronics (silicidation for electrical contacts) and photonics (waveguide writing). The planned developments will lead to measurements with sub-picosecond resolution that must allow monitoring potentially counter-propagating solidification fronts in nanometric layers. Interpretations will be supported by optical simulations of thin-film systems. The results from these ultrafast optics experiments will contribute to a better understanding of the surface annealing processes for an improved control of the final material state, considering its crystalline structure and transformation depth.
The developments will be made in the frame of an ANR project (https://anr.fr/Projet-ANR-23-CE08-0029) leading to potential interactions with an industrial partner (STMicroelectronics) and a support from a theory group (Lab. Hubert Curien, St Etienne). The activities are also conducted in the context of an international collaboration with CSIC-IO Madrid, Spain

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