ULTRAFAST IN-SITU ELLIPSOMETRY FOR STUDYING INTERACTIONS OF LASER PULSES AND MATERIAL SURFACES

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Monitoring the changes in material properties during pulsed laser excitation opens a pathway towards better understanding of the fundamental nature of laser induced processes. On one hand ultrafast single wavelength ellipsometry is an appropriate candidate for following such changes, since it provides more information than a conventional pump and probe reflection measurement. On the other hand the retrieval of the data is model based which necessitates the involvement of a broad spectral range.

Very recently, we demonstrated a unique, ultrafast pump-probe null-ellipsometry method, capable of assessing rapid changes of temperature and charge density upon femtosecond laser pulse irradiation [1]. To overcome the limitation due to the single wavelength of the probe pulse we rebuilt our measurement setup. Now it uses synchronized white light generated by femtosecond laser pulse (part of the pump) focused into a bulk glass plate, and operates as a quasi-rotating compensator ellipsometer.

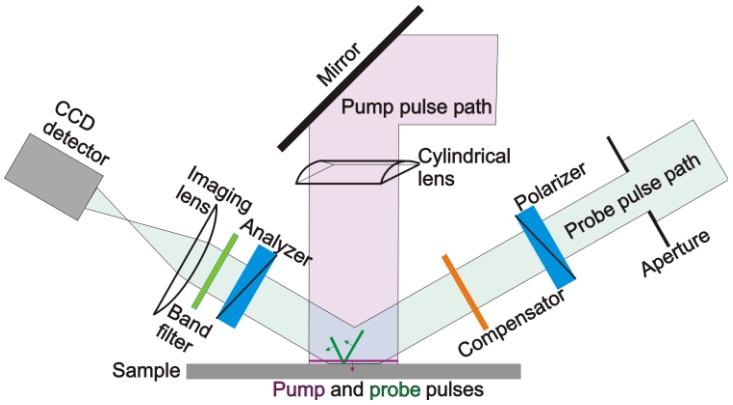

Fig. 1. Experimental setup

In this presentation, details of both experimental setups will be given. Advantages and disadvantages will be discussed through the example of silicon irradiated with fs laser pulses.

We believe that our results are not only interesting for the ellipsometric community but also represent an important contribution for applications in material science where ultrafast excitation of charge carriers is involved.

Keywords: Pump and probe method; Laser excitation; Silicon; Two-temperature model

References

[1] J. Csontos, Z. Toth, Z. Pápa, B. Gábor, M. Füle, B. Gilicze, J. Budai, Applied Surface Science 421 (2017) 325–330