Review of the Thesis “Ultrafast carrier dynamics in semiconductor studied by time-resolved terahertz spectroscopy” by RNDr. Ladislav Fekete

The doctoral thesis “Ultrafast carrier dynamics in semiconductor studied by time-resolved terahertz spectroscopy” deals with the study of the interaction of terahertz radiation with photoexcited carriers in semiconductors, particularly in radiation-damaged indium phosphide and microcrystalline silicon. The main attention is focused on the carrier dynamics on the femtosecond to nanosecond time scales. Also optical control of the terahertz reflectivity of semiconductors was studied and the ultrafast opto-terahertz photonic crystal modulator was demonstrated.

The thesis consists of six papers and an extended introduction divided into three chapters. In the first chapter a review of generation, detection and possible applications of terahertz radiation is presented. Used experimental setups and principles of the ultrafast terahertz spectroscopy are described in the second chapter. The last chapter is devoted to the original results of the papers included in the thesis. The four attached papers were published in international peer-reviewed journals, one paper was accepted and one was submitted. The author of the thesis is placed on the first position among the authors except one paper.

The work is written in English. The text is clear, well arranged and logically coherent. There is a very small number of typographical and typing errors. The used theoretical and experimental methods and procedures are fully adequate for the studied topics. The work brings very interesting findings, which may extend knowledge about ultrafast processes in the studied semiconductors.

I have several questions:

1) What is the intensity fluctuation of pulses produced by the femtosecond multi-pass amplifier? Did these fluctuations affect on the measurements?

2) What is the state-of-the-art and outlook of utilization of microcrystalline silicon in solar cells?
3) Is it known, what is the origin of shallow and deep states at the small grain and the large grain boundaries in microcrystalline silicon that act as localized centers for excited carriers?

The thesis “Ultrafast carrier dynamics in semiconductor studied by time-resolved terahertz spectroscopy“ proves the qualifications of the author for an independent creative scientific work. I recommend the thesis for the defense.

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Doc. RNDr. František Trojánek, Ph.D.
KCHFO MFF UK