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Report on the manuscript of Lukas Ondic

The work of Mr. Lukas Ondic is dedicated to 'Silicon nanocrystals, photonic structures and optical gain'. This work is mainly focused on spectroscopic studies of Silicon nanocrystals, on the design of photonic crystals and the coupling with the emission of these nanocrystals. The manuscript of Mr Lukas Ondic is well written, and is divided into seven chapters.

The two first chapters are devoted to introductions on silicon nanocrystals and photonic crystals. These chapters give the basic information that will serve the reader in the rest of the manuscript. First, a review of the band structure and optical properties of Silicon nanocrystals is given. This review is clear, well documented and the different issues are exposed. Secondly, the theory of photonic crystals and the way to use these structures to enhance both the light extraction and the optical gain is described. Once again, this part is well written and documented.

The third chapter presents the work done by Mr. Lukas Ondic on the photoluminescence of several types of Silicon nanocrystals. The description of the nanocrystals fabrication is first described. Then Mr. Lukas Ondic exposes the main optical setups that he used during his thesis both in Prague and Strasbourg. First, Mr. Lukas Ondic encloses a paper published in the 'Review of Scientific Instruments' that deals with the irising effect of a fast-grating intensified CCD. This effect is a source of artifacts in time resolved photoluminescence experiments. Mr. Lukas Ondic proposes in this paper a process to correct this effect on the data. This paper, published in a good journal, demonstrates the precision with which Mr. Lukas Ondic is working. Three other papers are enclosed, and for one of them Mr Lukas Ondic is the first author. They all deal with spectroscopic studies on Silicon nanocrystals. They treat for instance of the microscopic origin of the luminescence bands (so-called F- and S- bands), and on the influence of strain on the optical properties of these nanocrystals.

The fourth chapter deals with measurements of optical gain in layers of Silicon nanocrystals. The two experimental methods (VSL and SES) are well described and a particular attention is paid on the artifacts that may happen in these kinds of measurements. Once again, it demonstrates the precision with which Mr. Lukas Ondic is working. First, experiments on a well known organic laser dye are reported. These experiments serve to validate the method and are very convincing. Secondly, several samples with, for instance, different surface passivation are explored. These first examples point out the importance of the nanocrystal fabrication method and of the excitation source to measure optical gain on this material. Two papers in high quality journals are enclosed in this chapter, for one of them Mr Lukas Ondic is the first author. The first one deals with optical gain measurements. The time resolved measurements allow to separate the contribution of both F- and S- bands. The more convincing gain

measurement is done on the F-band at short time. The second paper reports theoretically on the amplification of light in low gain material interacting with a photonic crystal.

The fifth chapter is devoted to extraction of light thanks to the design of a photonic crystal on the top of a nanocrystalline diamond layer. The emitters which are coupled with the photonic crystal leaky modes are color centers of diamonds such as the well known N-V centers. Two papers published in high impact journals are enclosed in this chapter. For both of them, Mr. Lukas Ondic is the first author. Both papers demonstrate the enhancement of light extraction from the nanocrystalline diamond layer thanks to the coupling of the emitted light with the photonic crystal leaky modes. In the manuscript, as well as in the papers, the design of the photonic structure, the experimental methods and the discussions are clear and convincing.

The sixth chapter constitutes the last experimental report of the manuscript. Its content is a logical consequence of the work described in the previous chapters. It presents results on the coupling of the emission of Silicon nanocrystals with photonic crystals structure. The goal is to control the luminescence of the Silicon nanocrystals thanks to the coupling with the modes of a photonic crystal. Two kinds of photonic crystals are explored: a diamond photonic crystal slab; a silica photonic crystal. These experiments are reported in two papers published in high quality journals. For both of them Mr. Lukas Ondic is the first author.

Finally the seventh chapter presents the conclusion and the perspective of Mr. Lukas Ondic. The reader can appreciate the height of view of the author.

The manuscript written by Mr. Lukas Ondic reports an impressive number of scientific results. Most of these results are published in high quality journals and Mr. Lukas Ondic is the first author on seven of them. After having read the manuscript and these papers, I have no doubt that Mr. Lukas Ondic deserves the title of doctor. Therefore, I am in favor of the defense of Mr. Lukas Ondic.

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