

## **Review**

of the Ph.D. Thesis of Jakub Ševčík

entitled:

### **Preparation and characterisation of nanocomposite thin films applicable in organic electronic**

The thesis deals with experimental results of nanosystems based on ZnO/MEH-PPV (poly 2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene) in the form of nanocomposite films implemented in active layers of PLED devices. Addition of nanoparticles enhanced the luminance of prepared diodes comparing to those made of neat MEH-PPV polymers. Two different dopants namely iron and aluminium in various concentration levels were used to modify bandgap of the material. Both the opening bias and luminance of prepared diodes were greatly enhanced showing potential of their practical use.

Polymer conductive films can be applied in flexible imaging devices, displays, and light-emitting devices or in photovoltaics – areas of very fast development nowadays.

A new way of preparation of thin films as active layers in the PLED devices was developed. Size of nanoparticles, their composition on one side and thickness of thin films depending on conditions of their preparation on other side influence performance of PLEDs. The introduced approach showed potential for the construction of devices with industrial-scale application potential.

The thesis itself follow the template commonly used at Faculty of Technology. Introduction into topic is very well structured and with the help of carefully prepared figures provides sufficient inside into field of interest of student. The author used 92 references mainly from recent scientific papers showing very rapidly developing research area. Then, after formulation of Thesis aims chapter with selected results and discussion is presented. Again very careful preparation is evident, very good English and minimum typing errors. Based on results discussion relevant conclusions are formulated together with contribution of research work to science and practice. Furthermore, most of the results were already published in scientific journals included in Web of Science database or at international conferences.

Because of specific research area student had to handle with a variety of sophisticated techniques such as electron microscopy, X-ray diffraction, UV-VIS spectroscopy and also with devices used for sample preparation such as spin coater.

In order to stimulate discussion of results during defence I prepared e few questions:

- 1) In figure 15 threshold film thickness of 150 nm is shown for data from reference 55. What would be the threshold film thickness of systems presented in Thesis, if known?

- 2) The use of Fe or Al-doped ZnO decreases or increases intensity of electroluminescence. Data for concentration from 1 – 10 % are presented. Is there some limit that could be reached?
- 3) In which application you can see the highest potential of systems you developed?

The comments and questions introduced above do not diminish the quality of scientific level of Jakub Ševčík and his contribution to the field of Technology of Macromolecular Compounds. I fully recommend accept this Thesis and after successful defence to award Jakub Ševčík Philosophiae Doctor (Ph.D.).

Otrokovice 27.11.2019

Assoc. Prof. Vladimír Pavlínek

