

Tomas Bata University in Zlin, Polymer centre

Degree programme: P3972 Nanotechnology and advanced materials

Degree course: 3942V006 Nanotechnology and advanced materials

Review Report for Doctoral Thesis: Preparation and Characterisation of Nanostructured Materials for Electronic Gas Sensor Devices

Author: David John Dmonte, M.Sc.

The thesis, "Preparation and Characterisation of Nanostructured Materials for Electronic Gas Sensor Devices," brings important contribution and novelty to the field of technology of sensors for gaseous substances detection. The thesis encompasses research studies in three main areas: zinc oxide sensing, bismuth ferrite sensing, and chromium vanadate sensing. In each area, various fabrication techniques and characterization methods are employed to study the gas sensing properties of the materials towards enhancing detection capabilities. The work demonstrates the successful preparation of sensors with reasonable sensitivity, selectivity, stability, and response repeatability. Finally, a prototype sensing device are fabricated for tested target gases.

The dissertation presents a comprehensive introduction to the issue, accompanied by citations from published articles and various presentations of results. It contributes significantly to society through its exploration of the subject area, providing valuable insights and future prospects in the field. Additionally, it includes standard appendices such as the student's biography and other relevant documentation. The thesis is written in English, exhibiting logical organization and appropriate structure, but with some non-editing errors. Furthermore, the student has fulfilled all other study obligations and successfully passed the state exam.

I would like to add four questions to the student.

1. Could you provide a detailed explanation of the information depicted in Figure 2.2, illustrating the gas concentration detecting range of typical gas sensors? How does this graph help in understanding the capabilities and limitations of various gas sensing technologies?
2. Could you please clarify the concept of non-linear fitting as referenced in Figure 8.10? What insights or advantages does it offer in analysing the data presented in the figure?

3. Figure 8.11 displays very promising results. Considering these outcomes, have you explored any additional parameters or variables that could further enhance the sensor's performance? Additionally, in your experimentation, did you assess the durability of the sensor, maintaining its long-term ability to detect?
4. Could you please describe the method used to preheat the CrVO_4 sensor to achieve a measurement temperature of 330°C ? Specifically, what heating apparatus or technique was employed, and were there any specific considerations to ensure uniform heating and stability of the sensor at the desired temperature?
5. At the conclusion, I noticed that in most of the gas detection figures, you listed resistance change rather than the declared sensor response. Could you provide insight into why resistance change was chosen as the parameter of interest over sensor response?

Based on the mentioned considerations, I recommend the thesis to examination committee for a positive evaluation, I propose awarding the Ph.D. degree for David John Dmonte, M.Sc.

In Zlín, 29.4. 2024

Prof. Ing. Petr Slobodian, Ph.D.