

Project Outcomes Report: First Year After Project Implementation

Introduction

The aim of the “Planar Field Emission Microtriode Structure” project was to develop a new microtriode device using conventional planar semiconductor technologies. This approach simplifies the manufacturing process and makes it easier to integrate the microtriode with audio amplifiers. The project is a collaborative effort between Riga Technical University, the University of Latvia, and AS “ALFA RPAR,” and it is funded by the European Regional Development Fund.

Main Achievements

1. Knowledge and Technology Transfer

- **Patent** **Registration:**
On August 20, 2024, Patent No. LV15846B was granted for a field emission element with a planar cathode. This patent protects the microtriode design that uses standard manufacturing processes, ensuring a low operating voltage (below 10 V) and good electron emission.

2. Prototype Maintenance and Improvement

- **Status:**
In the first year after project implementation, work is actively being done on developing an encapsulation method, but a practical solution has not yet been found. Future work will seek better solutions to ensure the device’s long-term and stable operation.

3. Scientific Communication and Conferences

- **Conference** **Presentation:**
In August 2024, researcher Līga Avotiņa and her colleagues presented their results at the international conference “Advanced Materials and Technologies” held in Palanga, Lithuania. The presentation reviewed a study on the behavior of tungsten boride nanofilms under thermal conditions, showing that the materials in the triode maintain their properties even after prolonged heating.
- **Publication:**
The paper “Estimation of Thermal Stability of Si-SiO₂-W Nanolayered Structures with Infrared Spectrometry” was published in the journal *Materials* (DOI: 10.3390/ma17010007). This paper provides information on the thermal stability of the nanolayers and further confirms the design approach of the microtriode.

Future Plans

Future work will focus on:

- Improving the vacuum encapsulation technology.
- Completing the integration of the microtriode with audio amplifier circuits.
- Enhancing the manufacturing process based on the prototype testing results.

Conclusions

The first year after project implementation has shown that the new microtriode device functions in line with the initial objectives. Although practical work on maintaining and improving the prototype has not yet been completed, efforts on developing the encapsulation method continue, and future work will aim to find a more effective solution for stable operation. The project outcomes lay the foundation for further development in both research and industry, promoting simpler and more efficient production of microelectronic devices.