Institute of Applied Physics
Friedrich-Schiller-Universität Jena

Thermal Simulation of VO2-Based Micro-Optical Devices

Background:

VO2 thin films are increasingly being used in micro-optical devices, making it vital to understand their thermal behavior under various operational conditions for optimal performance.

Objective:

The main goal of this research is to create a detailed thermal model for micro-optical devices using VO_2 thin films. This model will look into how temperature changes impact the device's performance, see if the model can show changes in the optical properties of VO_2, and offer suggestions for improving the design for different conditions.

Methodology:

- Thermal Modeling (e.g. in COMSOL): Create a 3D model of the micro-optical device, implementing the thermochromic behavior of VO_2 as a variable.
- Validation Tests: Conduct experimental measurements of thermal behavior in actual devices, for validation of the simulation model.
- Parametric Study: Perform sensitivity analyses to understand the effect of various design parameters on thermal performance.
- Optical Measurements: Use spectroscopic methods to assess the optical properties at different temperatures, providing additional data for validation.
- Optimization Algorithms: Utilize optimization algorithms within COMSOL or other software to propose design changes that improve thermal performance.

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Literature:

M. Walther et al. (2023), *Switchable optics based on guided mode resonance in lithographically patterned vanadium dioxide with integrated heating layer.* http://dx.doi.org/10.1051/jeos/2023019

Workman, Gus (2020), *Thermal Cycling Reliability of Vanadium Dioxide Films for Switching Applications.* https://doi.org/10.1016/j.cej.2022.137556