Accurate estimation of Young's modulus of VO_2 thin film integrated on polyimide for high strain studies

Lahaye L., Roisin N., Raskin J.P., Flandre D.

April 2025

VO_2 is a promising material that features both an hysteretic phase change near room temperature and interesting properties such as a high gage factor of up to 250 [*Inomata & al*. 2018]. Values have been reported for polycrystalline VO_2 thin film mainly deposited by reactive sputtering to form classical MEMS membrane and measured at low strain.

This work presents a 220 nm-thick VO_2 thin film integrated on a 3.2 µm-thick and 2.5 mm-wide polyimide membrane. The use of polyimide allows to induce strain up to 1%. This work combines finite element simulations and white-light interferometry measurements of the membrane to study the high-strain properties of the VO_2 material. The fabricated samples are used to estimate the Young's modulus of the film to solve the high uncertainty reported in the literature. Indeed, a wide range of modulus are given in the literature due to the important impact of process parameters on film topology [*Sepúlveda & al*. 2008 and *Carbera & al*. 2014]..

Fitting the simulation parameters on the experimental data allows to accurately estimate the modulus to 120 GPa for the considered film.