MUELLER MATRIX ELLIPSOMETRY INVESTIGATIONS OF INSULATOR METAL TRANSITION IN VO_2

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The nature of insulator to metal transition in VO_2, after more than half a century of investigations still remains under debate, though the convenient temperature of the transition attracts people to utilize it in many applications, especially in the field of plasmonics, as for example all-optical modulation or sensing. Thus there is a need for a precise prediction of temperature dependent optical properties in this material.

In this study, we concentrate on the macroscopic model which would describe the temperature dependence of optical constant over the transition in thin film VO2. We confirm the Bruggeman effective medium approximation [1] as a proper model describing the temperature dependence of optical constants of the material in visible and near infrared range even around the transition temperature. Using depolarization factor, which is related to the shape of the inclusions, as a free parameter, we obtain an improvement in overall mean square error of the model.

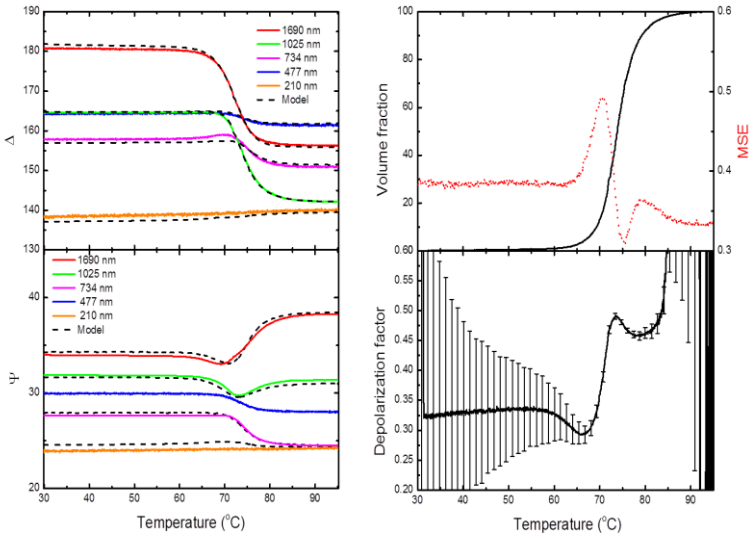

Fig. 1: Result of the BEMA

In addition, we observe that the depolarization of light in the sample is also temperature dependent. Moreover, it is linked to the observed transition and correlates with the filling fraction of metallic phase derived from the BEMA model. Thus it is an interesting observable to investigate the transition in terms of disorder induced by shape and size in the granular thin films.

Keywords: Insulator-metal transition; Ellipsometry; Effective medium approximation, Depolarization

References

[1]J. Rozen et al., Applied physics letters (2006), **88**, 081902.