



## Study toward size dependent solid state phase transition between $\gamma$ -WO<sub>3</sub> and $\epsilon$ -WO<sub>3</sub> via in situ cryogenic Raman spectroscopy

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Title:

**Study toward size dependent solid state phase transition between  $\gamma$ -WO<sub>3</sub> and  $\epsilon$ -WO<sub>3</sub> via in situ cryogenic Raman spectroscopy**

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Abstract:

The low-temperature WO<sub>3</sub> polymorph,  $\epsilon$ -WO<sub>3</sub>, has been shown to function as a highly sensitive and selective gas sensor for the detection of acetone, an important biomarker for metabolic disorders, and as the foundational material for various chromic devices.

Unfortunately, the kinetic and thermodynamic characteristics of the phase transformation between the room-temperature  $\gamma$ -WO<sub>3</sub> and  $\epsilon$ -WO<sub>3</sub> phase as well as the thermostability of the  $\epsilon$  polymorph is limited. Here, the low temperature phase transformation from  $\gamma$ -WO<sub>3</sub> into  $\epsilon$ -WO<sub>3</sub> is studied by using in-situ Raman spectroscopy. The results provide insight into the size dependency nature of this phase transformation. Specifically, the transformation onset temperature between  $\gamma$ -WO<sub>3</sub> and  $\epsilon$ -WO<sub>3</sub> is confirmed to be linearly proportional to reciprocal of average crystallite radius, which can be explained by several published thermodynamic models.

[1] O.O. Abe, Z. Qiu, Z. Chen, J.R. Jinschek, P.-I. Gouma, *Ceramics International* 2021