General information of $Ti_xV_{1-x}O_2$ thin films on (110) rutile TiO_2

Film Orientation:

(011) at room temperature, (110) at 80 °C

Sample Components:

$Ti_xV_{1-x}O_2$ thin films with alloying levels of 0%, 1%, 2.5%, 3.3%, 4%, 5.3%, and 8.6%.

Raman measurements details:

Angle and temperature-dependent Raman spectroscopic measurements were performed using a Renishaw inVia Raman microscope system. Series of Raman spectra in the temperature range between 0 °C and 80 °C were recorded using a Linkam THMS 600 temperature stage. The spectra were taken in backscattering geometry with 514 nm excitation provided by an Ar-ion laser. Excitation and scattered light passed through a long distance objective (50 ×, Olympus, NA = 0.45). The Rayleigh scattered laser light was rejected by an edge filter enabling the measurement of the Stokes Raman scattered light down to 100 cm^{-1}. The laser power on the sample was 1.9 mW and the spot size about 1 µm. Using polarization optics in the beam path allowed us to measure Raman spectra in parallel and crossed polarization configuration of laser and Raman scattered light. Angle-dependent measurements were realized on the same spot on the sample by rotating the polarizer arrangement in the beam path.

Angle α is between [001] direction of TiO_2 substrate and incoming polarization.

Angle-dependent Raman measurements were performed at room temperature with Angle α from 0 to 360 degrees in 10 degree steps.

Angle-dependent Raman measurements were performed at 80 °C with Angle α from -90 to 450 degrees in 15 degree steps.

XRD measurements details:

X-ray diffraction (XRD) traces were recorded with Panalytical X'Pert Pro MRD setups using the Cu-Kα line and an additional sample heater to reach temperatures between room temperature and 80 °C.

Resistance measurements details:

The sample’s electric resistance as a function of temperature was measured by using a linear four-contact geometry and a heater stage. Either tungsten carbide or steel needles with a diameter of 0.5mm were used as contacts. The total force applied to the needles was about 5 to 16 N. The distance between probes was 1 ± 0.01 mm. The resistance measurements were performed in autoranging mode. The heating rate was 2 °C/min.