# Raman spectroscopy of $TiS_2$ thin films

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Since the graphene unique properties has been discovered, other two dimensional materials like transition metal dichalcogenides are wildly investigated [1, 2]. One of these 2D materials is a titanium disulphide, which may by a promising candidate for applications in lithium-ion batteries, high conductivity electrodes or thermoelectric cells [3, 4]. To assure that $TiS_2$ can be used in any of these applications a better understanding of the material properties is needed. Raman spectroscopy is a powerful method for this purpose.
Here, we report the Raman spectroscopy measurements of the 1T - $TiS_2$ thin films on $SiO_2$/Si substrate. Samples were prepared by a standard mechanical exfoliation method from 1T - $TiS_2$ bulk crystal (figure 1).
In details, we show the temperature-dependent (80 - 450 K) Raman measurements of titanium disulphate (figure 2) with determination of the first-order temperature coefficients for each modes ($A_{1g}$, $A_{1g}$' and $E_g$). Moreover the evolution of the Raman modes as a function of the $TiS_2$ film thickness was designated.
These results contribute to the understanding of the thermal and optical properties in titanium disulphate films, which are crucial for use in a variety of future applications.

## References

[1] X. Zhang et al., Chem. Soc. Rev. **44** (2015) 2757.
[2] J. Ji et al., Physica E **80** (2016) 130.
[3] T. Matsuyama et al., J. Solid State Electrochem. **17** (2013) 2697.
[4] R. Elazari et al., Journal of The Electrochemical Society **159** (2012) A1440.

## Figures

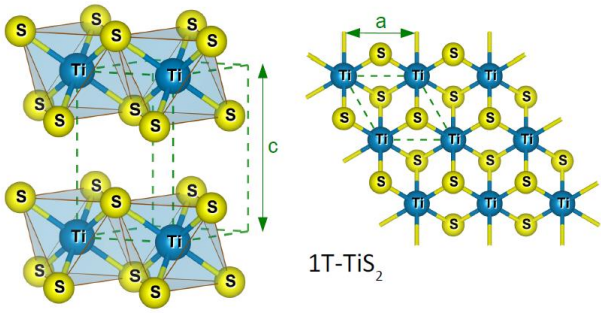


**Figure 1:** Crystal structure of 1T-$TiS_2$; side view - on the left and top view – on the right.

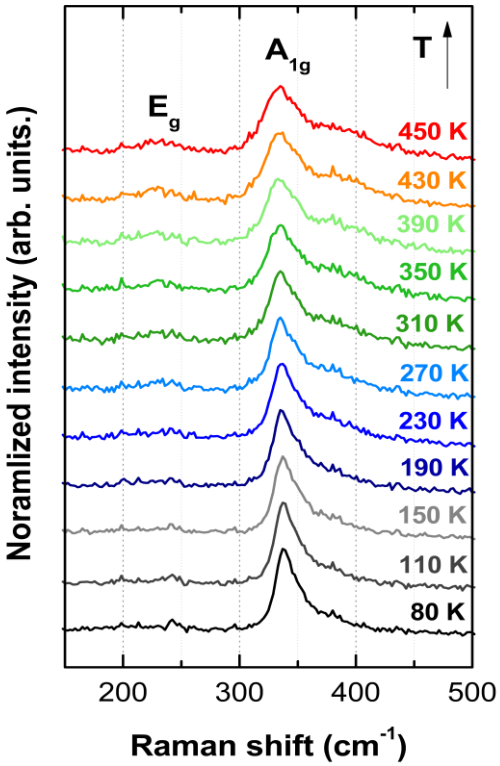


**Figure 2:** Normalized Raman spectra for ~ 80 nm thick $TiS_2$ film shown at selected temperatures, measured for 514 nm laser line.