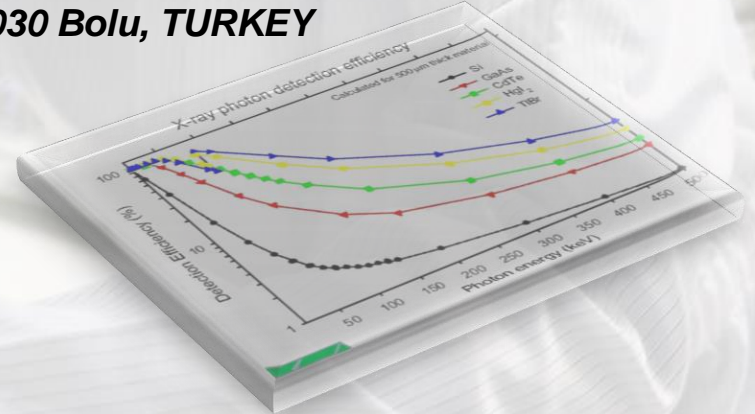


# **INVESTIGATION OF ELECTRICAL CHARACTERISTICS AND SURFACE MORPHOLOGY OF VANADIUM OXIDE-VO<sub>2</sub> MOS DEVICES**

**Umutcan GURER<sup>1,2</sup> and Ercan YILMAZ<sup>1,2,\*</sup>**

**<sup>1</sup> Nuclear Radiation Detectors Application and Research Center, BAIBU, 14030 Bolu, TURKEY**

**<sup>2</sup> Physics Department, Bolu Abant İzzet Baysal University, 14030 Bolu, TURKEY**



**06-10 July 2020, RAP 2020**

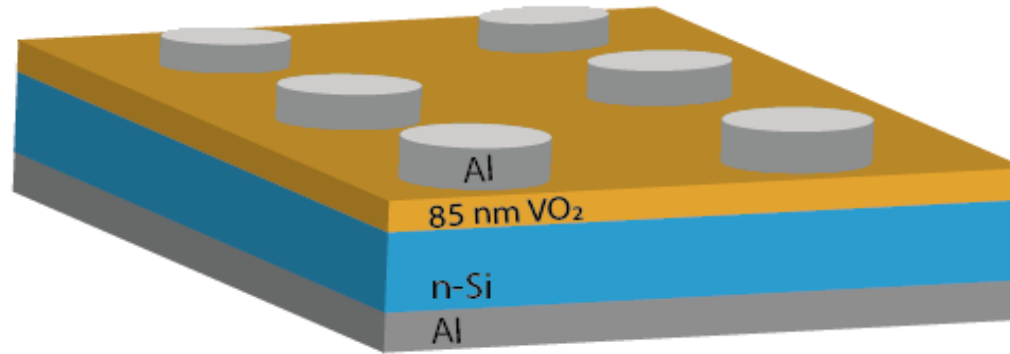
# *Content Outline*

- *Introduction*
- *Experimental Details*
- *XRD Analysis Results*
- *FTIR Analysis Results*
- *Electrical Characterization Results*
- *Conclusion*

# Introduction

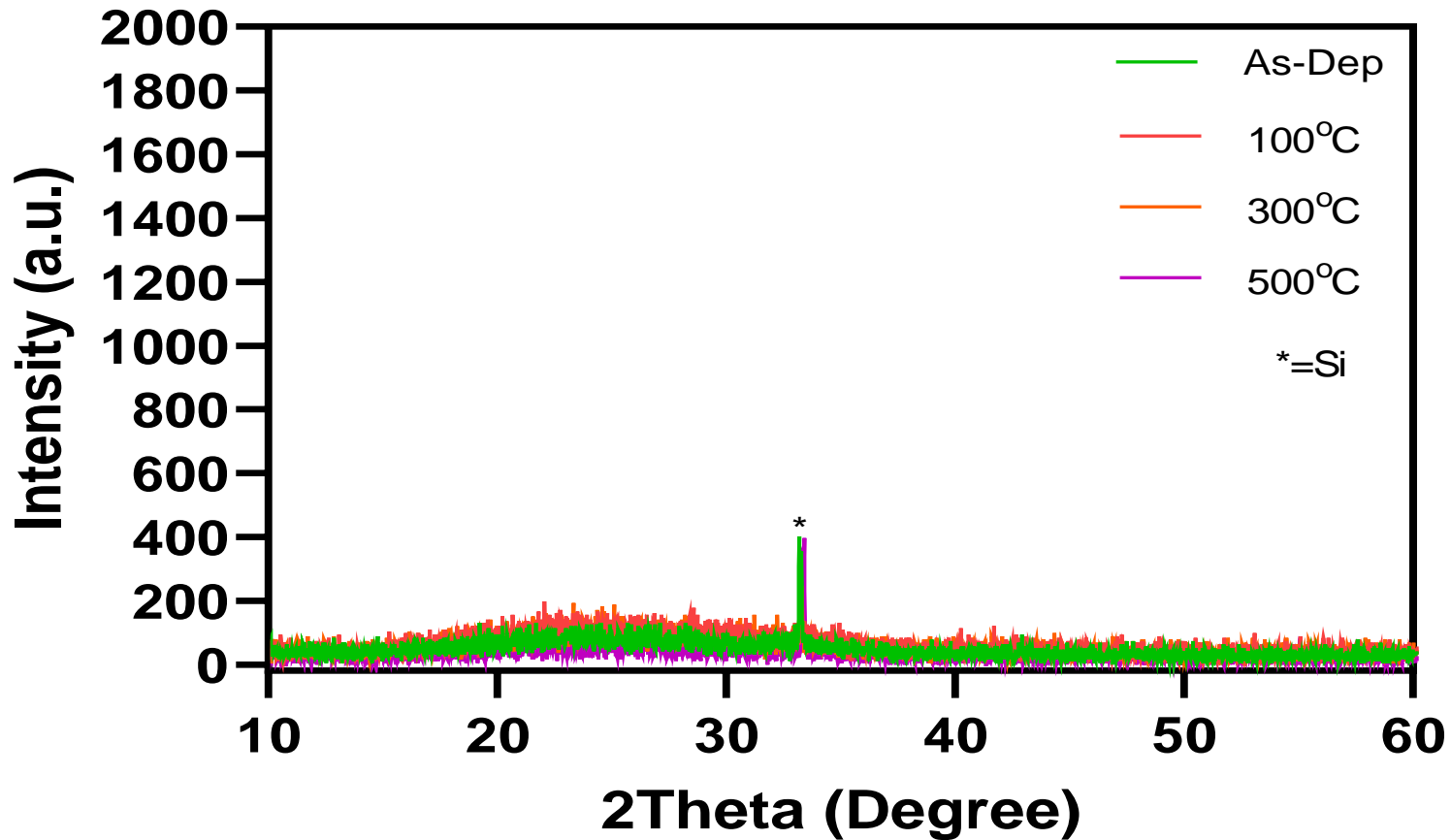
- ❖ Vanadium dioxide is well known for the semiconductor-metal phase transition at 67°C.
- ❖ Vanadium Oxide is also known to exist in multiple oxidation states (like +4 in  $\text{VO}_2$  and +5 in  $\text{V}_2\text{O}_5$ ).
- ❖ An increasing interest has been devoted to hybrid vanadium oxides due to their potential application as catalysts, sensors, and electrodes during the last years.
- ❖ Our goal; preliminary work of investigation of electrical and surface morphology of vanadium oxide for the application in MOS devices and MOSFET in radiation environment.

# Experimental Details



- ❖  $\text{VO}_2$  thin films with thickness of 85 nm were deposited on n-type silicon (100) substrate by using RF Magnetron Sputtering System.
- ❖ After deposition, samples annealed at 100 °C, 300 °C, 500 °C and 700°C under Ar ambient with Rapid Thermal Annealing (RTA) system .
- ❖ Electrical characterization were done by analyzing C-V and G/w-V @ 1 MHz.
- ❖ Surface Morphology was investigated by analyzing XRD measurements.
- ❖ Bond structures investigated by analyzing ATR-FTIR measurements.

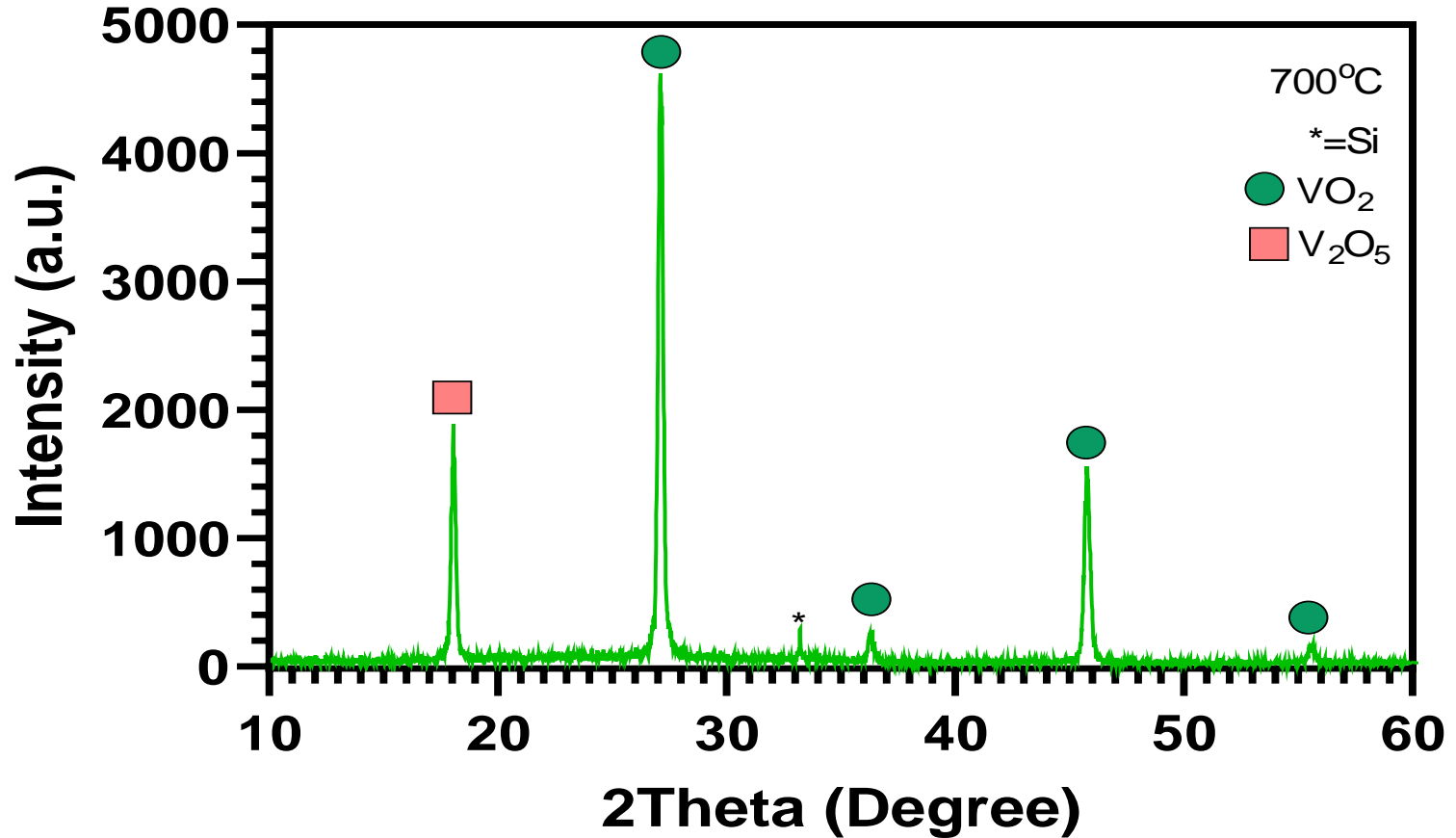
# *XRD (X-Ray Diffraction) Analysis Results*



- As-deposited and the samples annealed at 100°C, 300°C and 500°C showed amorphous structure.

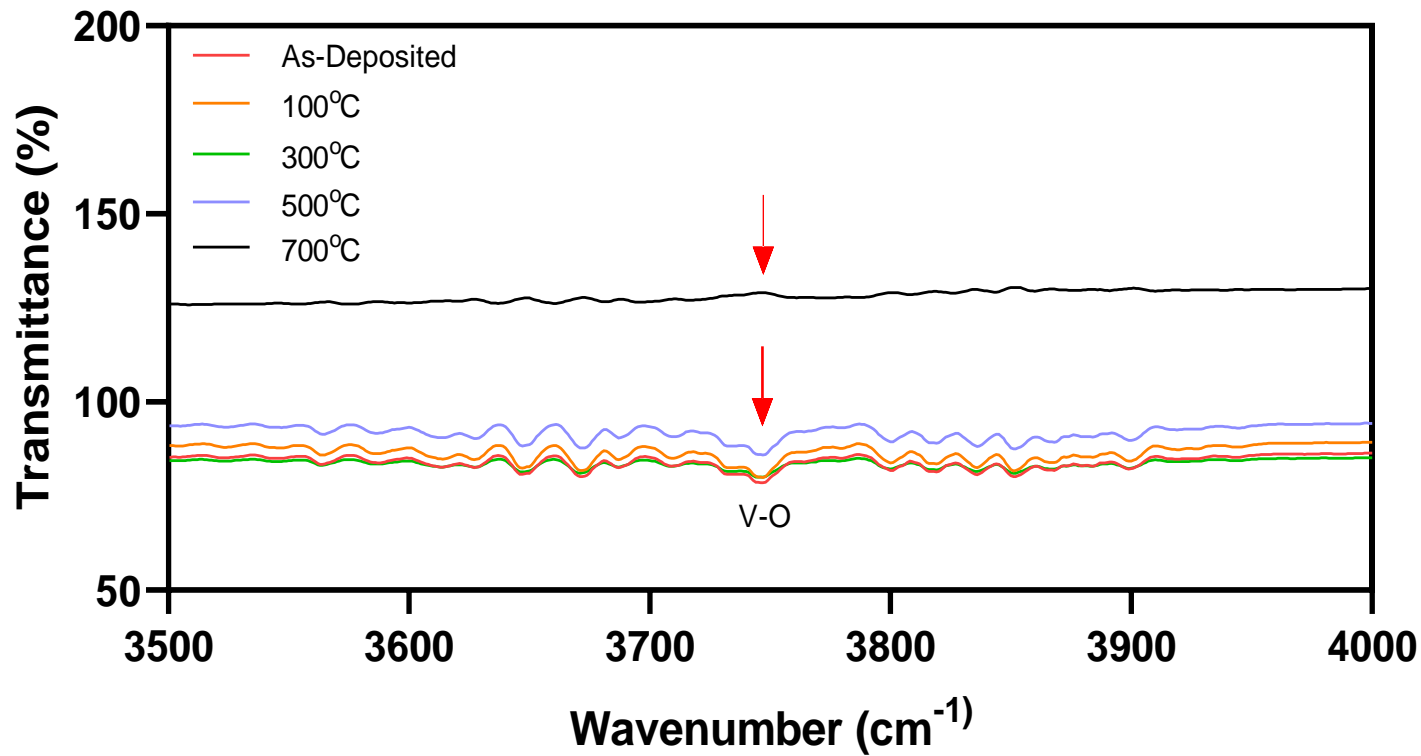
# XRD Analysis Results

- The sample annealed @700°C showed polycrystalline structure.

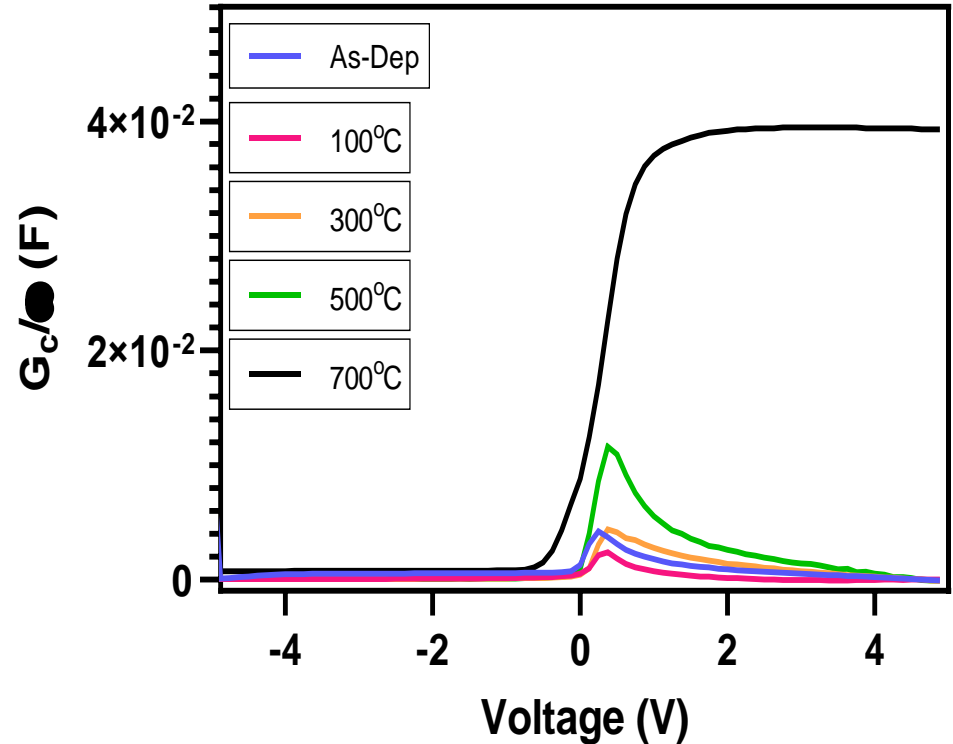
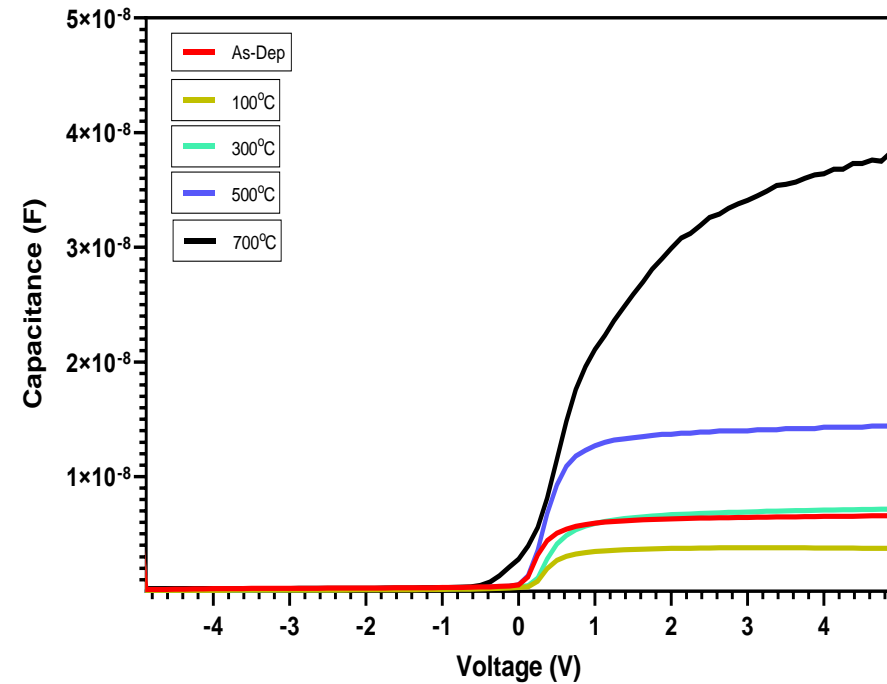


# FTIR Analysis Results

- The presence of peak at  $3745\text{ cm}^{-1}$  belongs to V-O bonds.
- The peak at  $3745\text{ cm}^{-1}$  was missing due to annealing temperature.



# Electrical Characterization Results



- The capacitance and conductance values showed increasing trend with the increasing annealing temperature.



# Conclusion

- XRD measurements showed that annealing had major effect on crystallinity on VO<sub>2</sub> thin films structures. Also, the polycrystalline structure has been found in 700°C annealed samples.
- The annealing >700°C has increased crystallinity of VO<sub>2</sub>.
- ATR-FTIR measurements revealed that V-O bond has been found on thin film structures @ 3974 cm<sup>-1</sup> wavenumber.
- The C-V and G/w-V analyses showed increasing trend with the increasing annealing.

## Acknowledgements:

This work is supported by the Presidency of Turkey, Presidency of Strategy and Budget under Contract Number: 2016K12-2834.



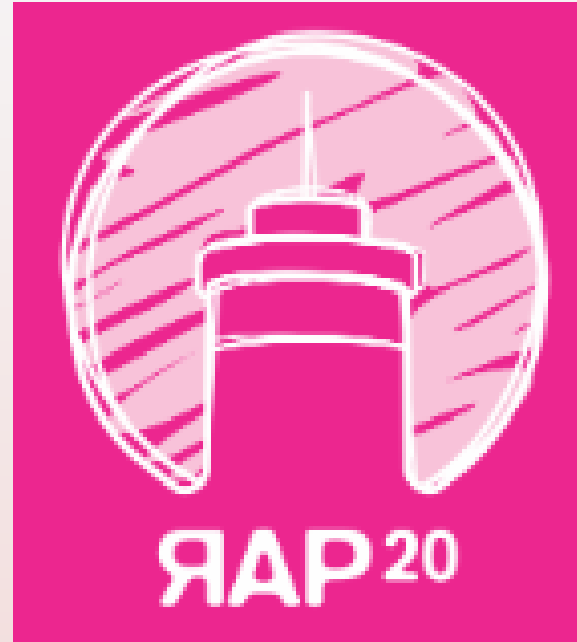
**NURDAM**

Nuclear Radiation Detectors  
Application and Research Center

**BAIBU**

Bolu Abant İzzet  
Baysal University





# Thanks for Your Attention



**NURDAM**

Nuclear Radiation Detectors  
Application and Research Center

**BAIBU**

Bolu Abant İzzet  
Baysal University

