

A presentation on

# UV photoconductive detector based on spray deposited ZnO thin films

By

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# Introduction

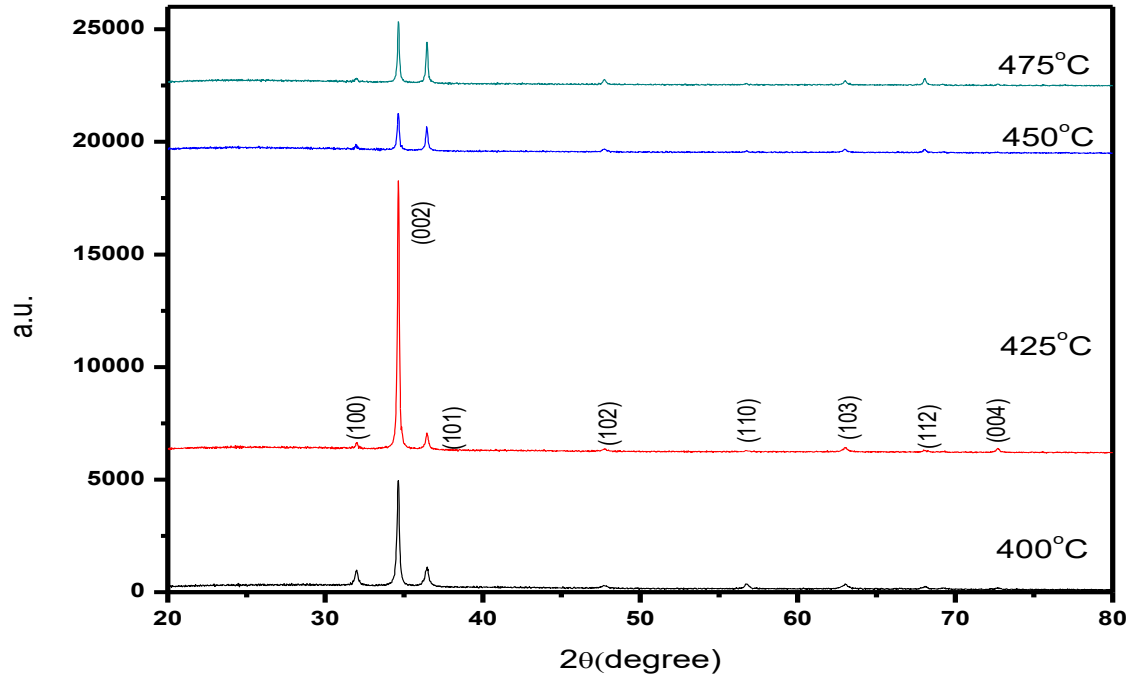
1. Zinc oxide (ZnO) nanostructures have been widely studied because of their potential for various applications, including solar cells, light emitting devices, electron emitters, photocatalysis and sensors.
2. ZnO is very promising material for use as sensing elements in ultraviolet (UV) photoconductive detector application because of a fast response and high photocurrent and are highly sensitive to UV light
3. ZnO material is advantageous for UV detection because of its wide band gap ( $E_g = 3.37$  eV) and high exciton binding energy (60 meV), as well as low-cost manufacturing and environmentally friendly.

# Experimental details

1. Precursor used: AR grade zinc acetate
2. Technique: Spray pyrolysis
3. Chemical concentration: 0.1M
4. Quantity: 100ml
5. Substrate Temperature: 400°C, 425°C, 450°C, 475°C

# Result and Discussion

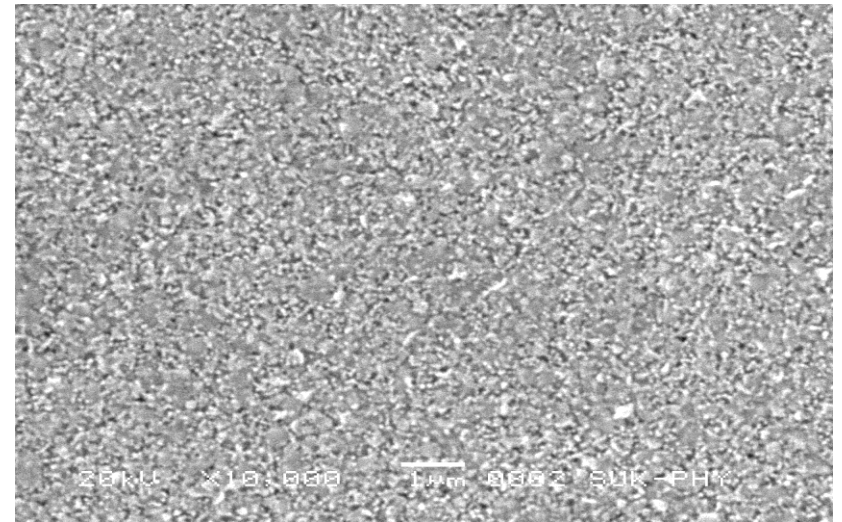
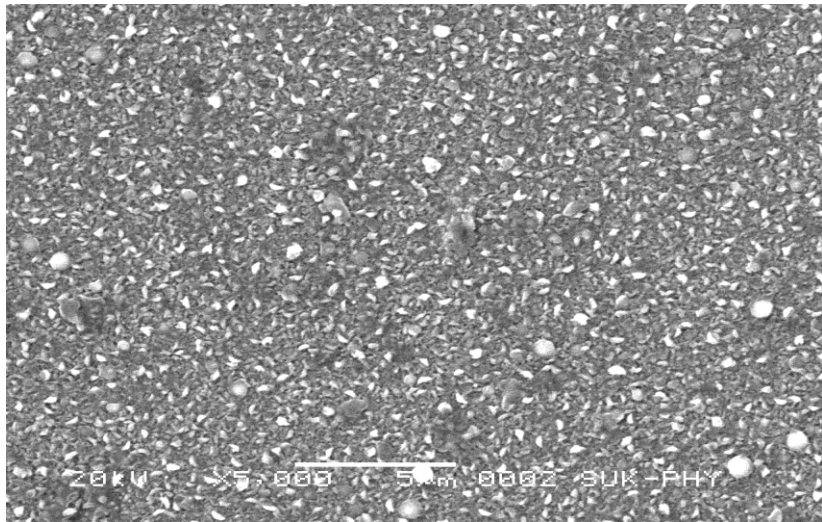
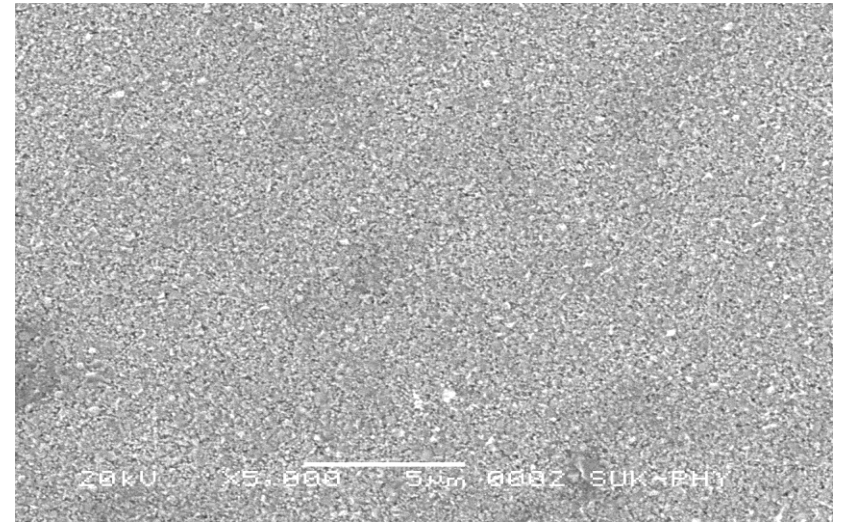
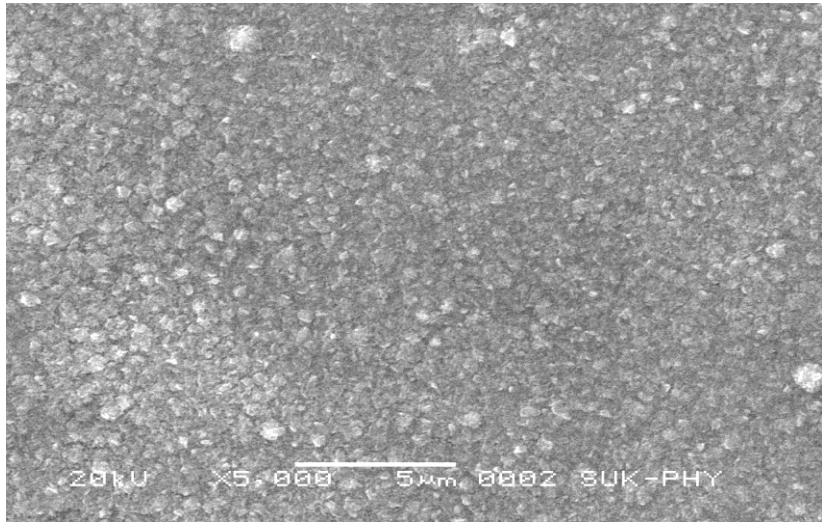
XRD:



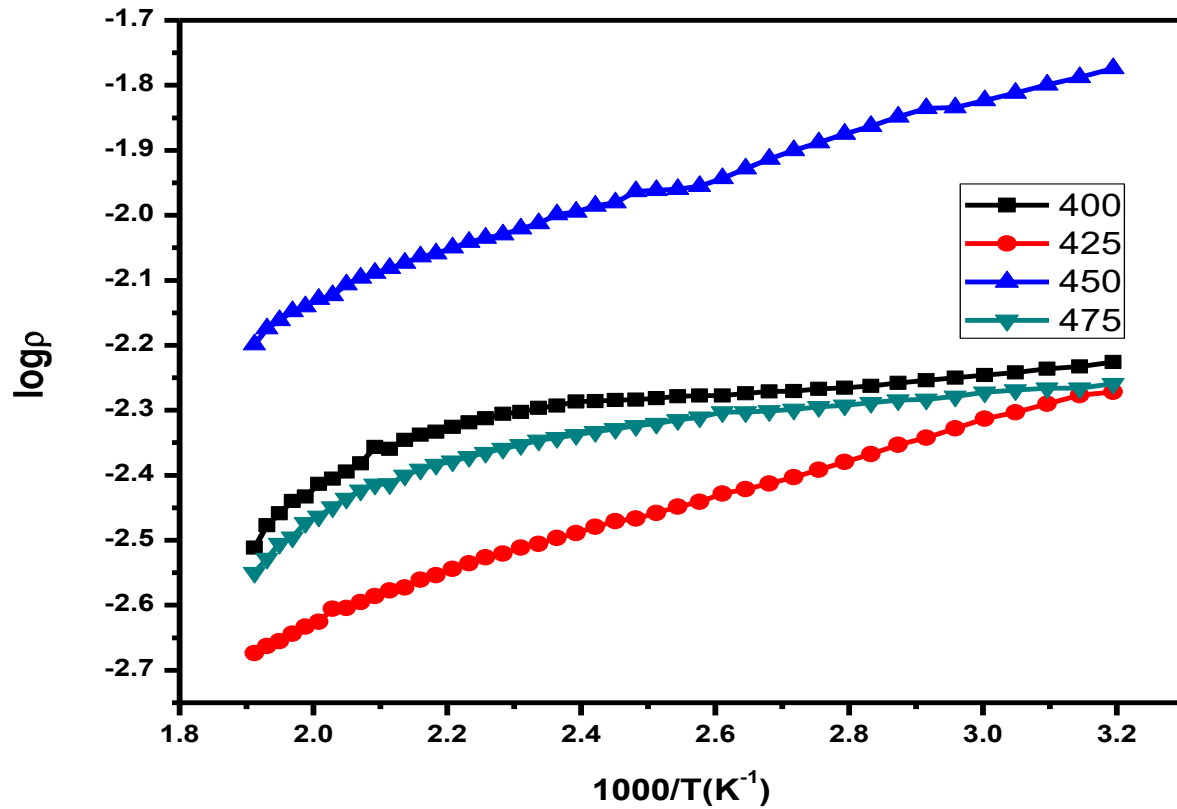
JCPDS code : 01-075-1526

Substrate temperature	400°C	425°C	450°C	475°C
Crystallite Size (nm)	33.73	35.14	34.03	33.92

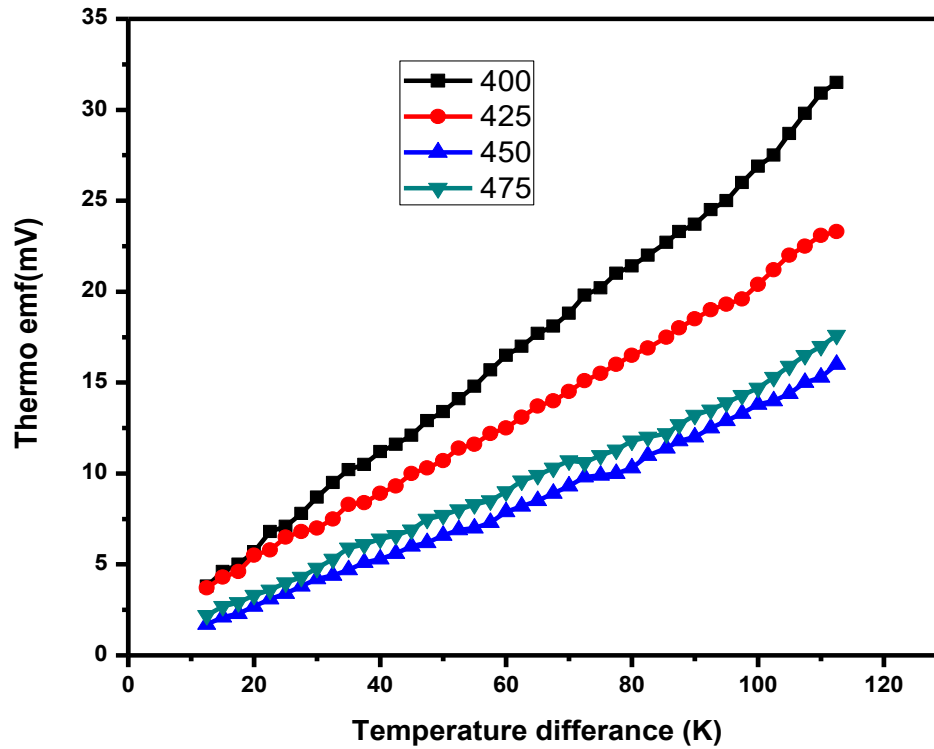
(h k l) planes	d values(calc ulated) (400°C)	d values(calc ulated) (425°C)	d values(calc ulated) (450°C)	d values(calc ulated) (475°C)	d values (standard)
(1 0 0)	2.79272	2.79505	2.79875	2.79683	2.7886
(0 0 2)	2.58763	2.58721	2.58762	2.58695	2.6
(1 0 1)	2.46055	2.46247	2.46321	2.4623	2.45756
(1 0 2)	1.90273	1.9027	1.90384	1.90392	1.90166
(1 1 0)	1.62101	1.62011	1.62063	1.62196	1.61
(1 0 3)	1.47329	1.47369	1.47424	1.47407	1.47212
(1 1 2)	1.3755	1.37706	1.3764	1.37626	1.36881
(0 0 4)	1.29945	1.29945	-	1.29945	1.3



**Scanning Electron micrographs for ZnO thin films for various temperature**

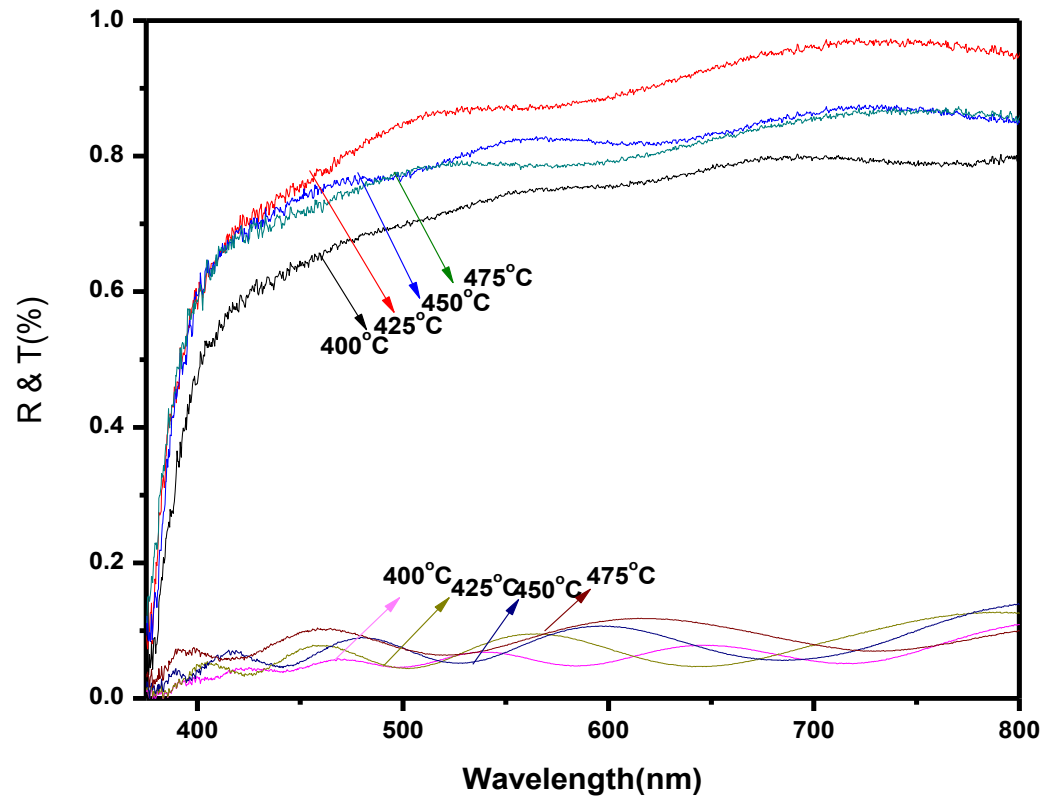


**Variation of resistivity with substrate temperature**

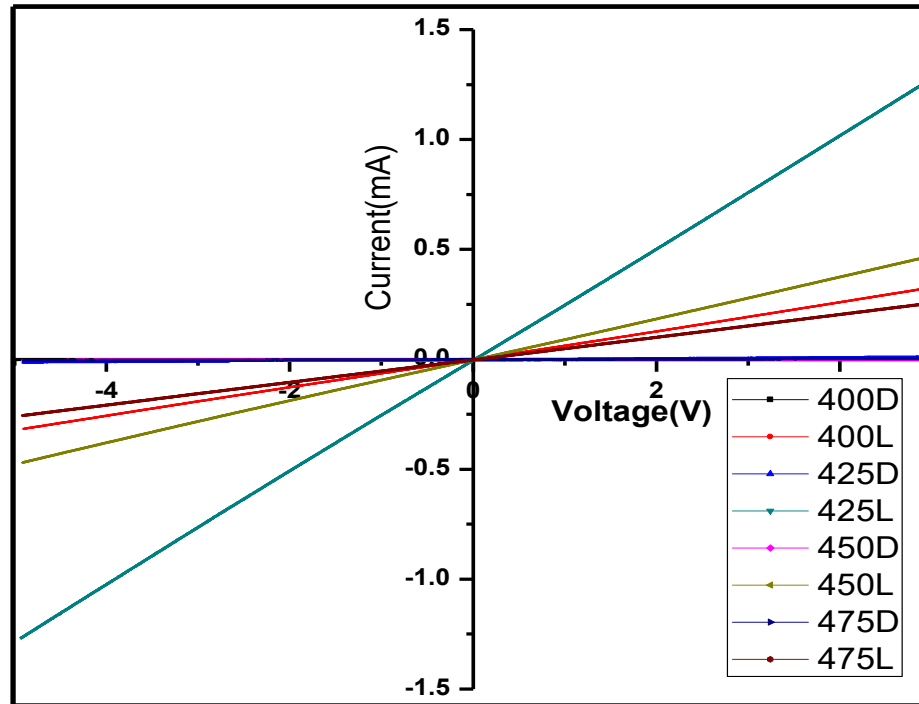


**thermoelectric power for different diposition temperatures**



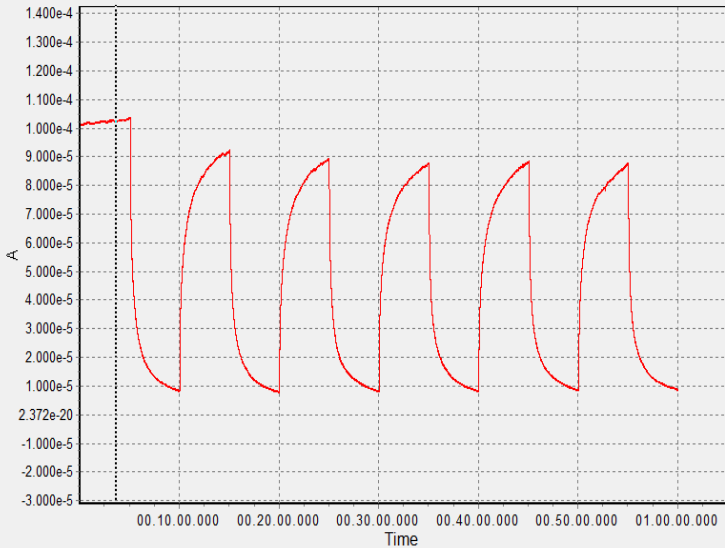


**Reflectance and transmittance spectra of ZnO thin films**



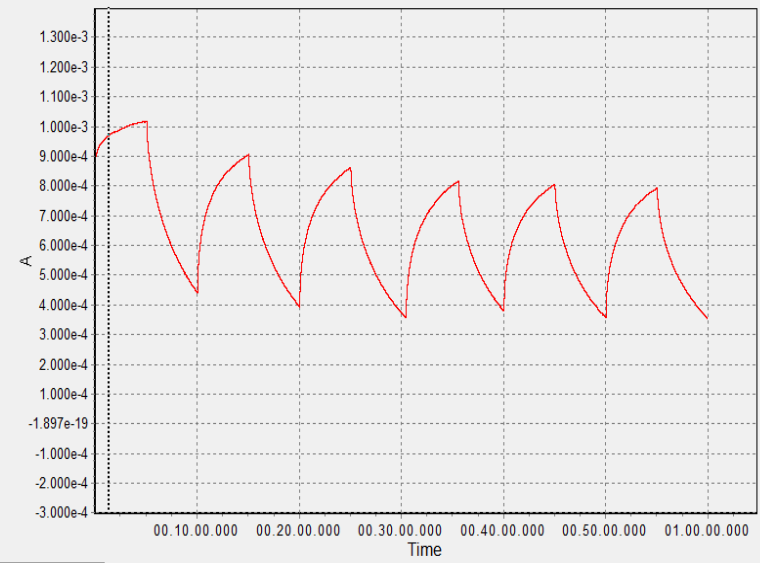
**I-V characteristic of ZnO based UV photodetector**

V1: 4.9989 A: 1.0229e-4 Q: 2.2106e-2 J: 1.1045e-1 W: 5.1132e-4 R: 4.8871e4 Time: 00.03.37.040 N: 21704  
V1: 4.9988 A: 8.7410e-6 Q: 8.7410e-8 J: 4.3695e-7 W: 4.3695e-5 R: 5.7188e5 Time: 01.00.00.090 N: 360009 CELL OFF



OCV V1: 0.0047 A: 0.0000e0

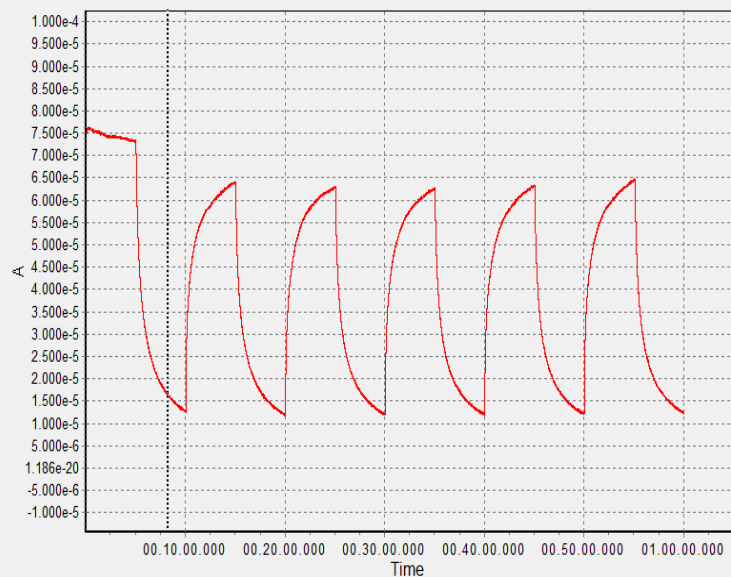
V1: 4.9991 A: 9.7033e-4 Q: 7.4526e-2 J: 3.7210e-1 W: 4.8508e-3 R: 5.1520e3 Time: 00.01.19.210 N: 7921  
V1: 4.9990 A: 3.5268e-4 Q: 2.3498e0 J: 1.1746e1 W: 1.7630e-3 R: 1.4174e4 Time: 01.00.00.020 N: 360002 CELL OFF



OCV V1: 0.0055 A: 0.0000e0

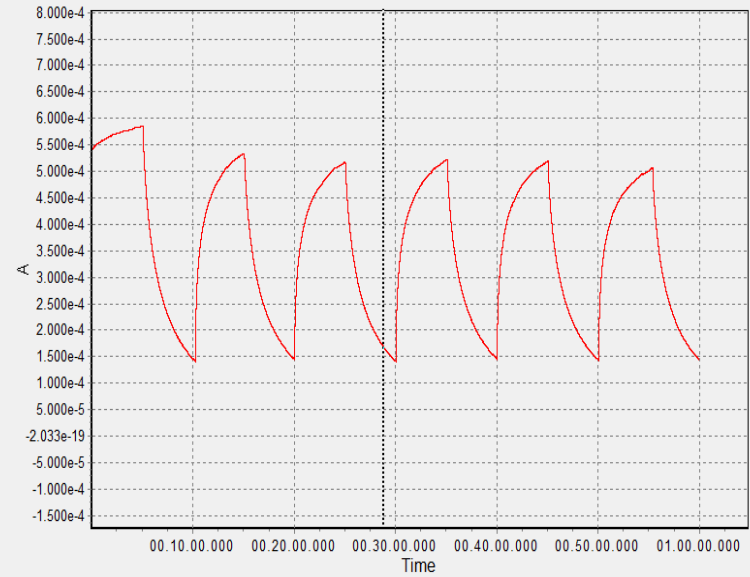
## Time dependence of photocurrent under modulated UV light source.

V1: 4.9995 A: 1.6366e-5 Q: 2.7772e-2 J: 1.3880e-1 W: 8.1821e-5 R: 3.0548e5 Time: 00.08.12.830 N: 49283  
V1: 4.9990 A: 1.2320e-5 Q: 1.4397e-1 J: 7.1967e-1 W: 6.1586e-5 R: 4.0577e5 Time: 01.00.00.070 N: 360007 CELL OFF

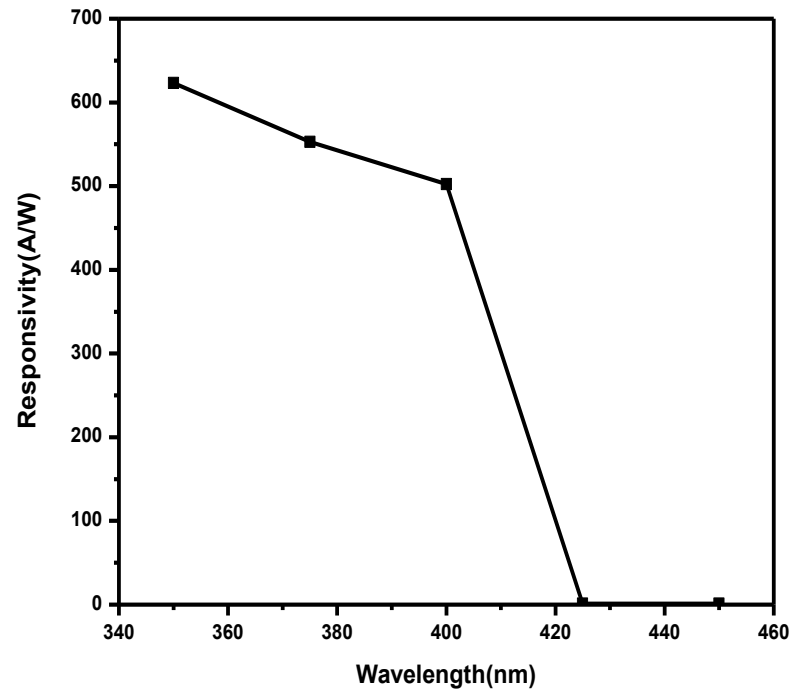


OCV V1: 0.0020 A: 0.0000e0

V1: 4.9991 A: 1.6813e-4 Q: 6.5528e-1 J: 3.2756e0 W: 8.4049e-4 R: 2.9734e4 Time: 00.28.48.230 N: 172823  
V1: 4.9989 A: 1.4369e-4 Q: 1.2929e0 J: 6.4630e0 W: 7.1829e-4 R: 3.4789e4 Time: 01.00.00.000 N: 360000 CELL OFF



OCV V1: 0.0046 A: 0.0000e0



**Photoresponsivity for the ZnO thin film deposited at 425°C substrate temperature**

## Conclusion:

1. XRD results show that hexagonal crystal structure of ZnO with crystallite size around 35 nm.
2. SEM images of ZnO thin films shows randomly distributed elongated grains.
3. The average transmittance of the ZnO thin films is about 85%.
4. Linear I-V characteristic in forward and reverse bias shows ohmic metal semiconductor contacts
5. ZnO photodetector has good photoconductivity.
6. ZnO film has a maximum responsivity of 622 A/W under a bias voltage of 5V.

**THANK**



**YOU**

