



# Comparison of DC and RF Sputtering of ZnSnN<sub>2</sub>: Effect on Structural, Optical and Electrical Properties

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# Comparison of DC and RF Sputtering of $\text{ZnSnN}_2$ : Effect on Structural, Optical and Electrical Properties

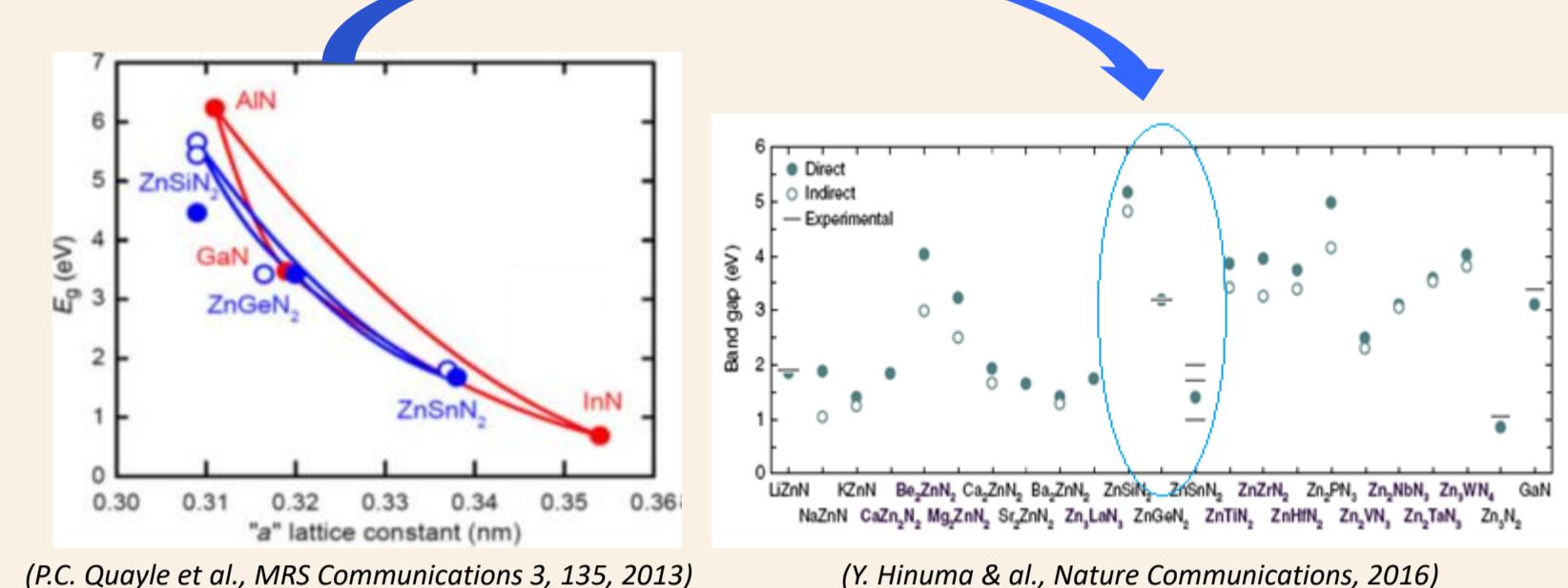
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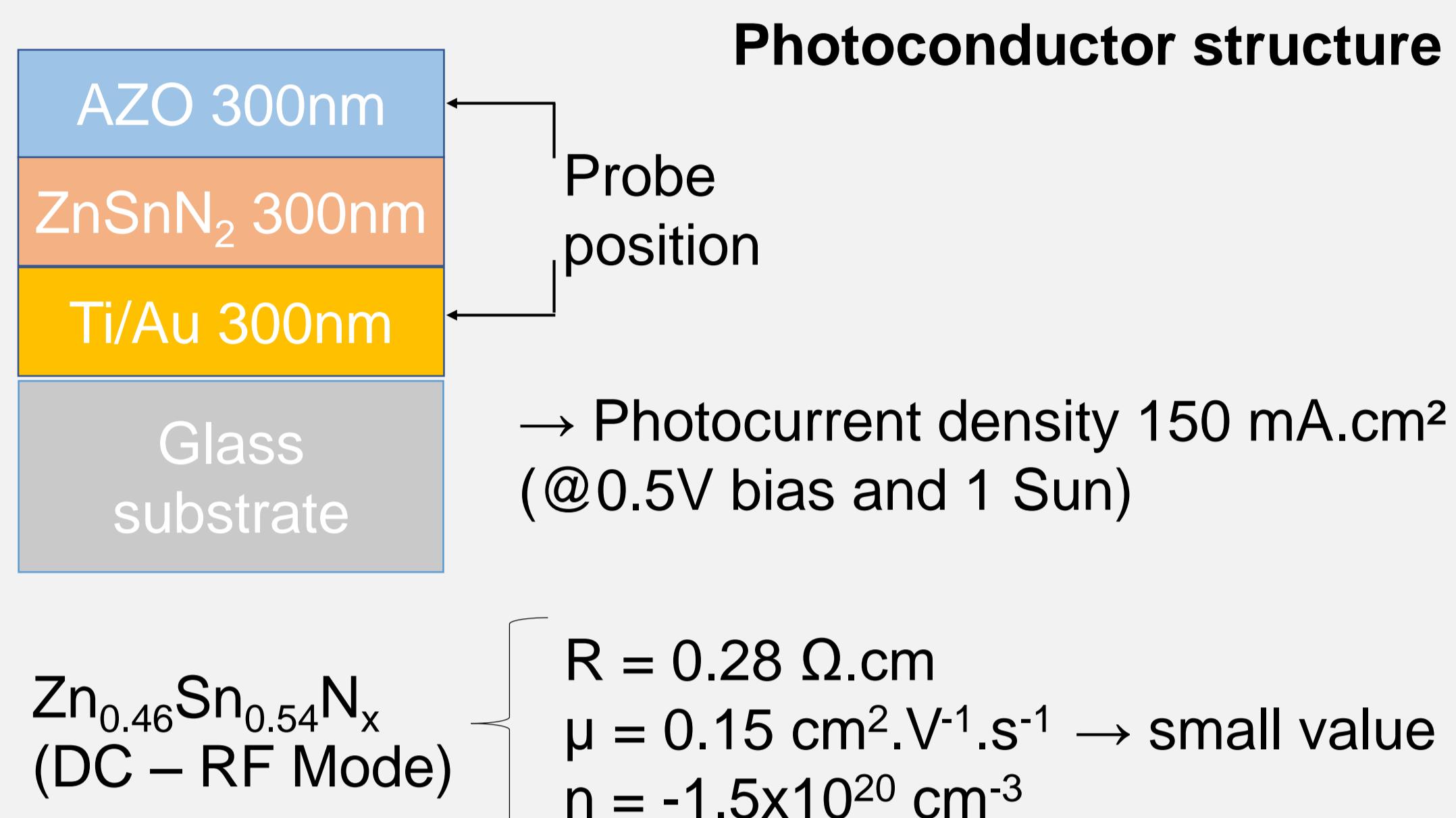
## Context

$\text{ZnSnN}_2$  is a member of ternary Zn-IV-N<sub>2</sub> semiconductors:  

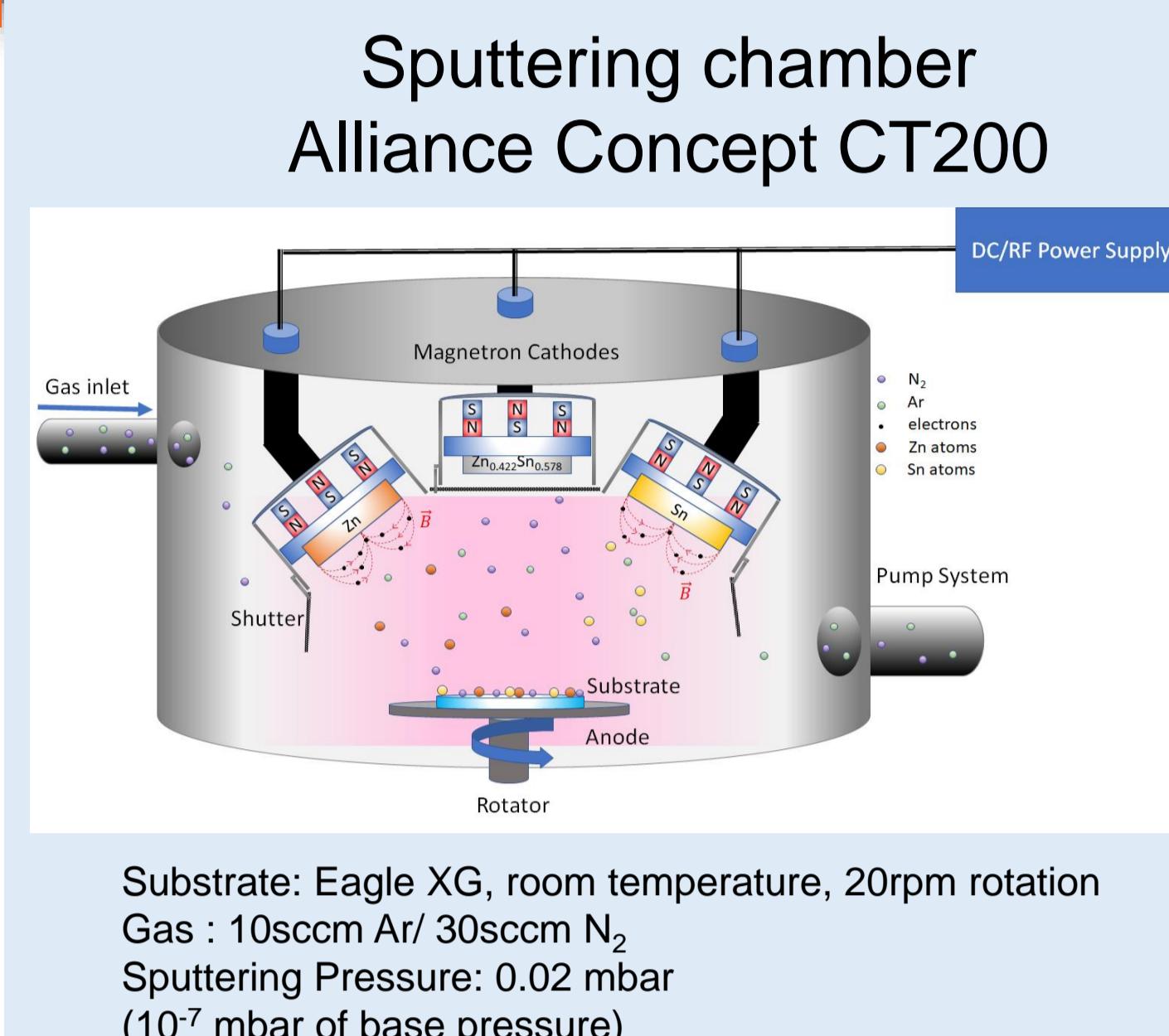
- Low cost and non-toxic raw materials
- Expected direct bandgap is approximate 1.7eV
- Crystal structure, ground-state structural properties and phonon related quantities look close to those of III-N.



## Our best result



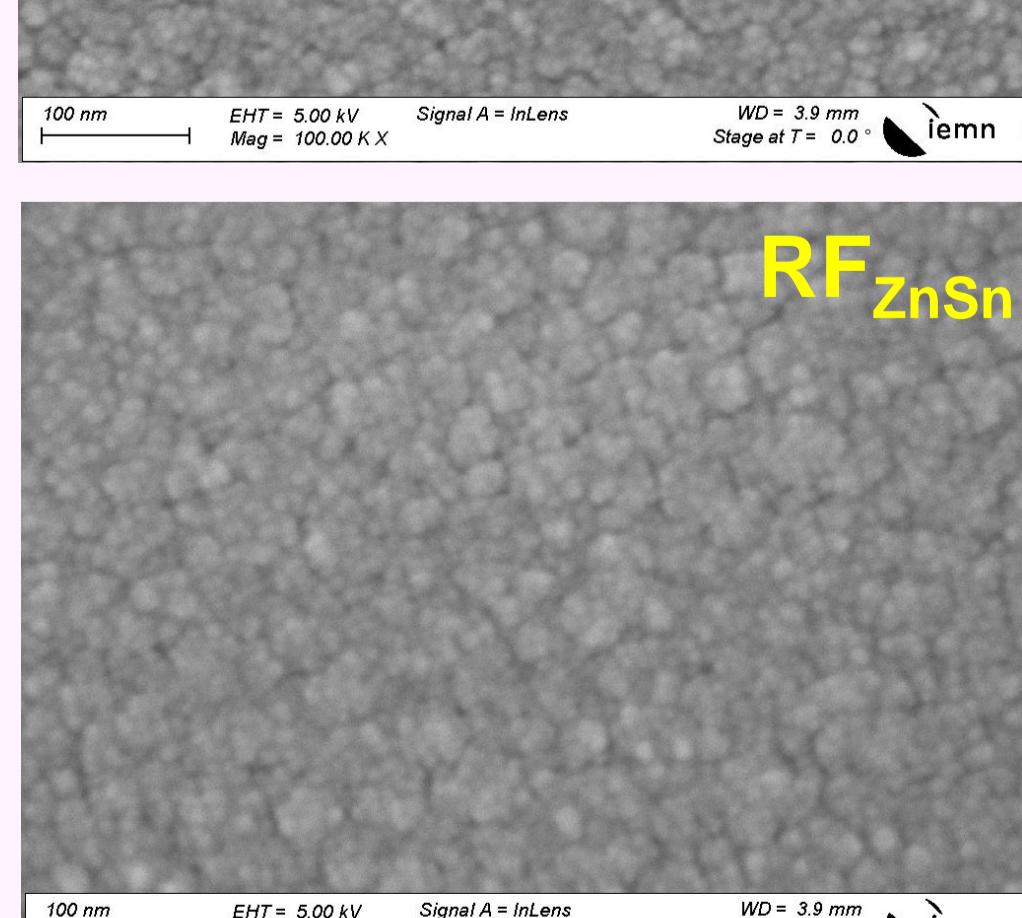
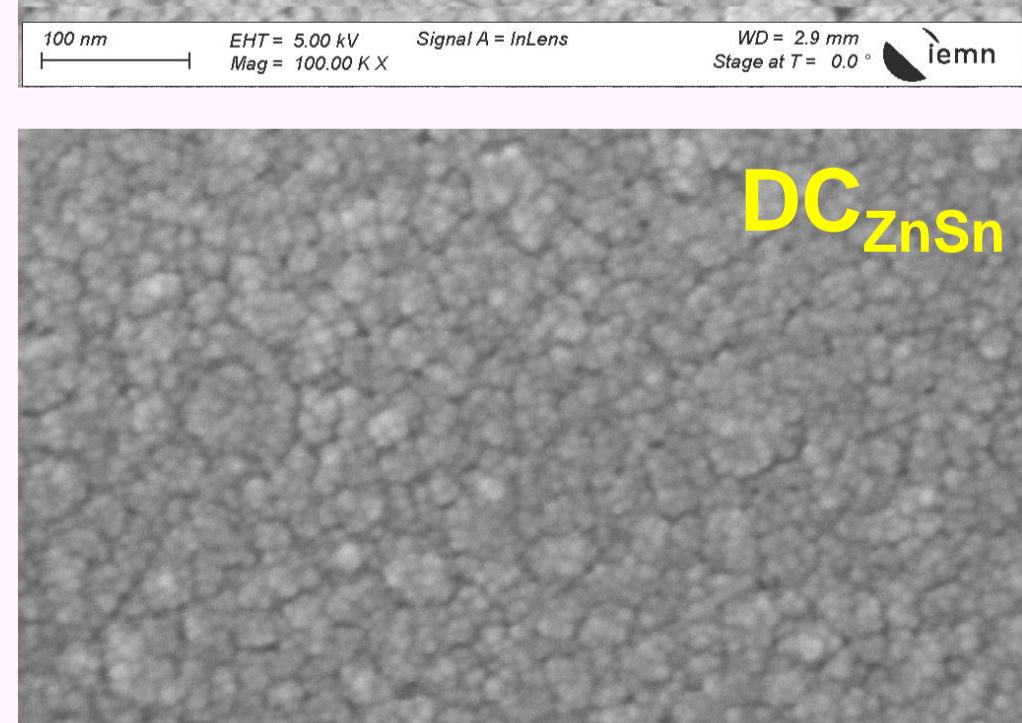
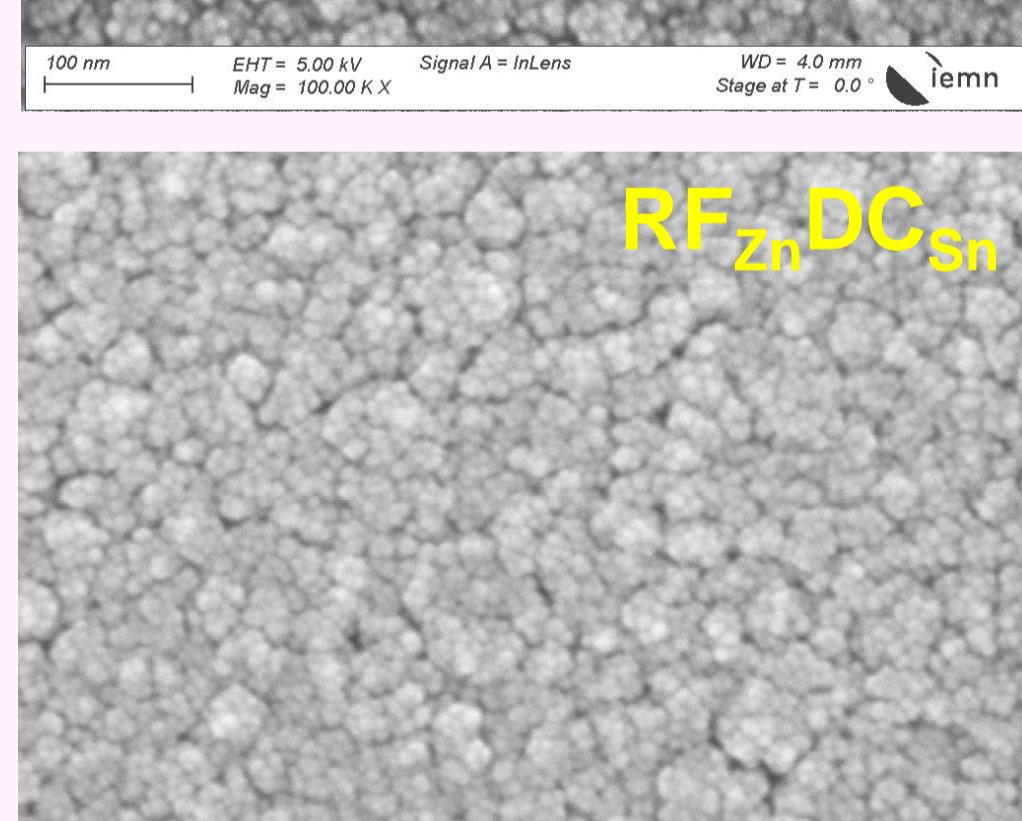
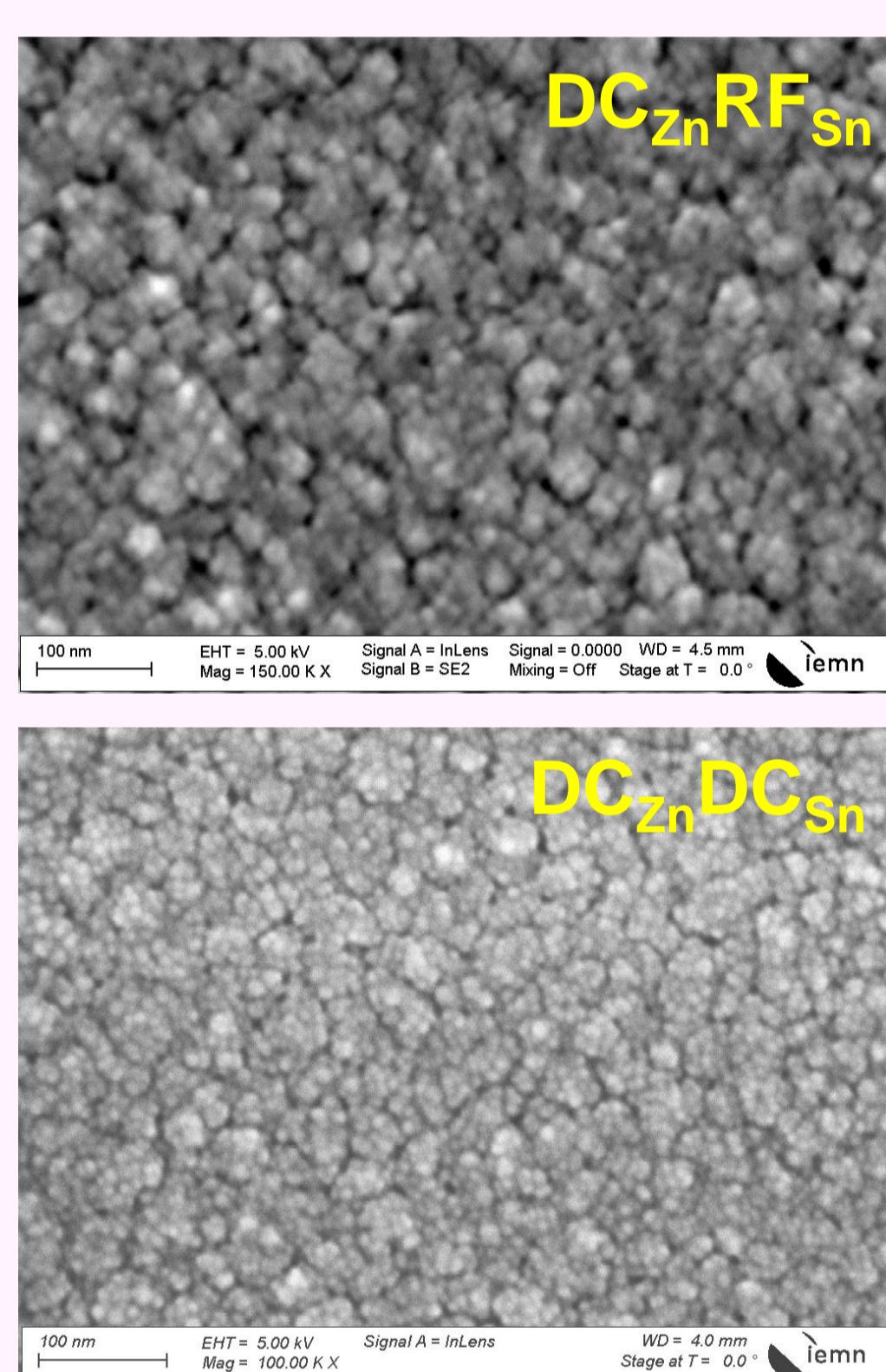
## Methods



## Results

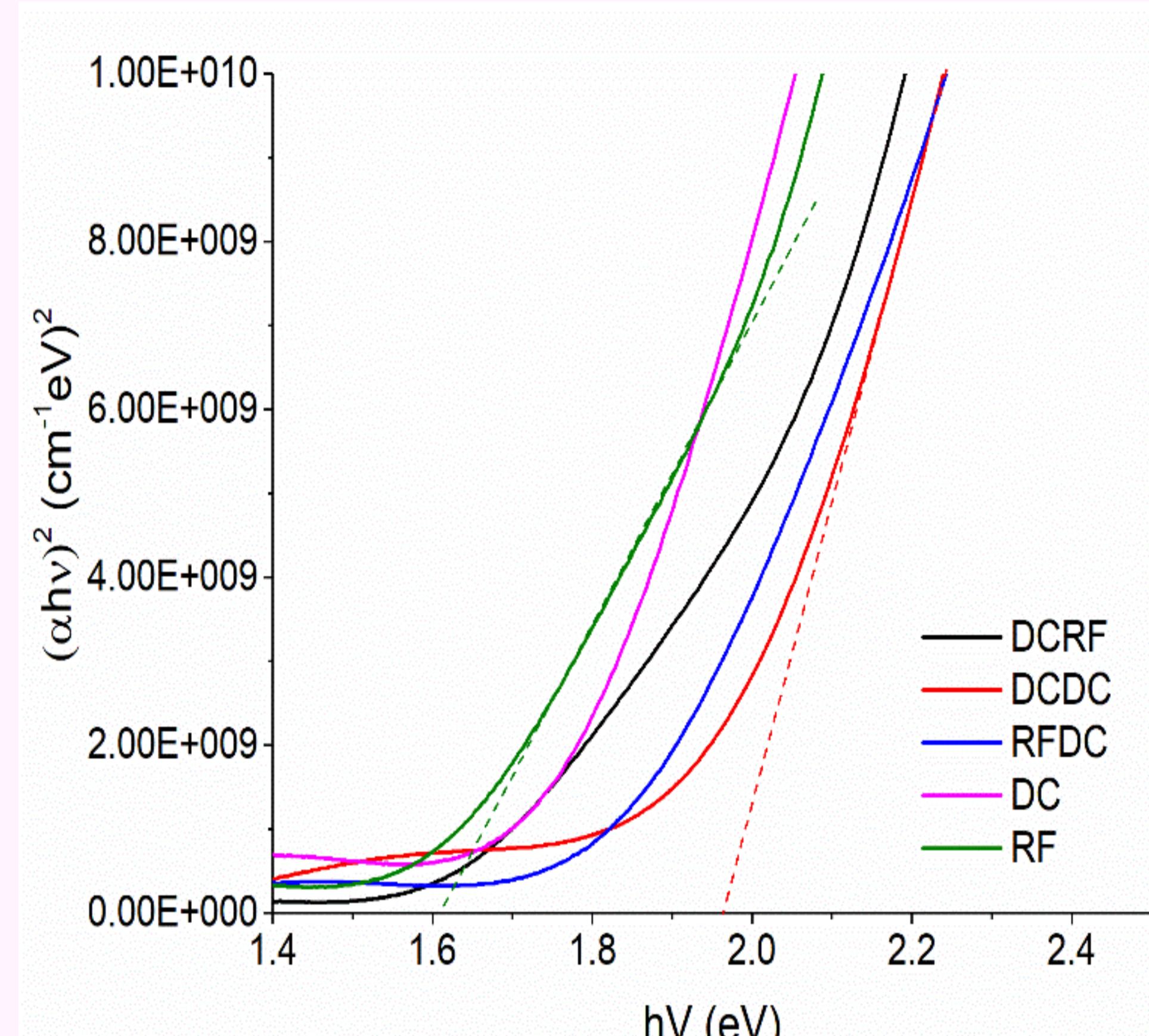
Deposition using different sputtering modes

	2 targets		1 target
	Zn	Sn	$\text{Zn}_{0.42}\text{Sn}_{0.58}$
<b>DC<sub>Zn</sub>RF<sub>Sn</sub></b>	DC	RF	
<b>DC<sub>Zn</sub>DC<sub>Sn</sub></b>	DC	DC	
<b>RF<sub>Zn</sub>DC<sub>Sn</sub></b>	RF	DC	
<b>DC<sub>ZnSn</sub></b>			DC
<b>RF<sub>ZnSn</sub></b>			RF

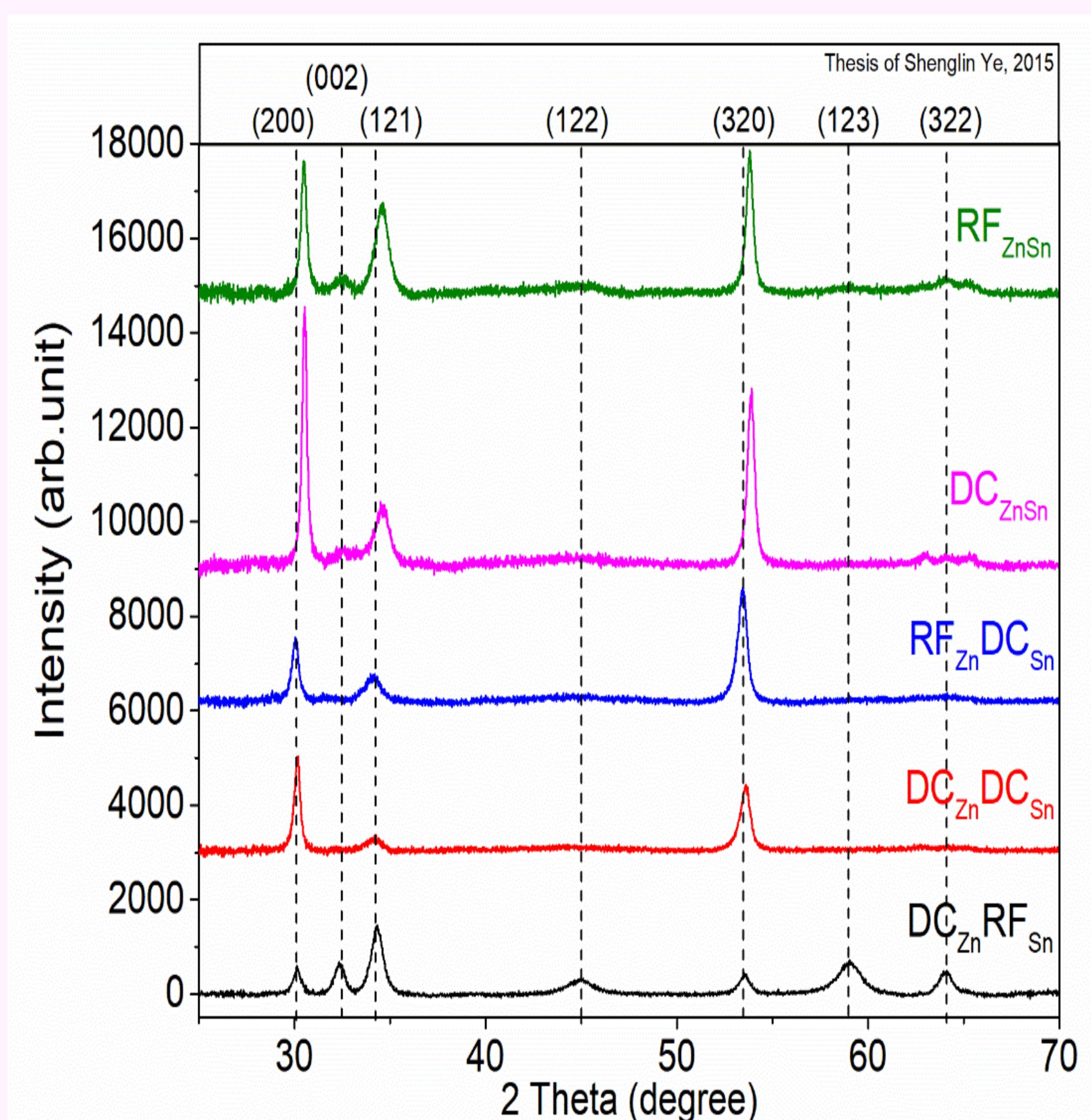
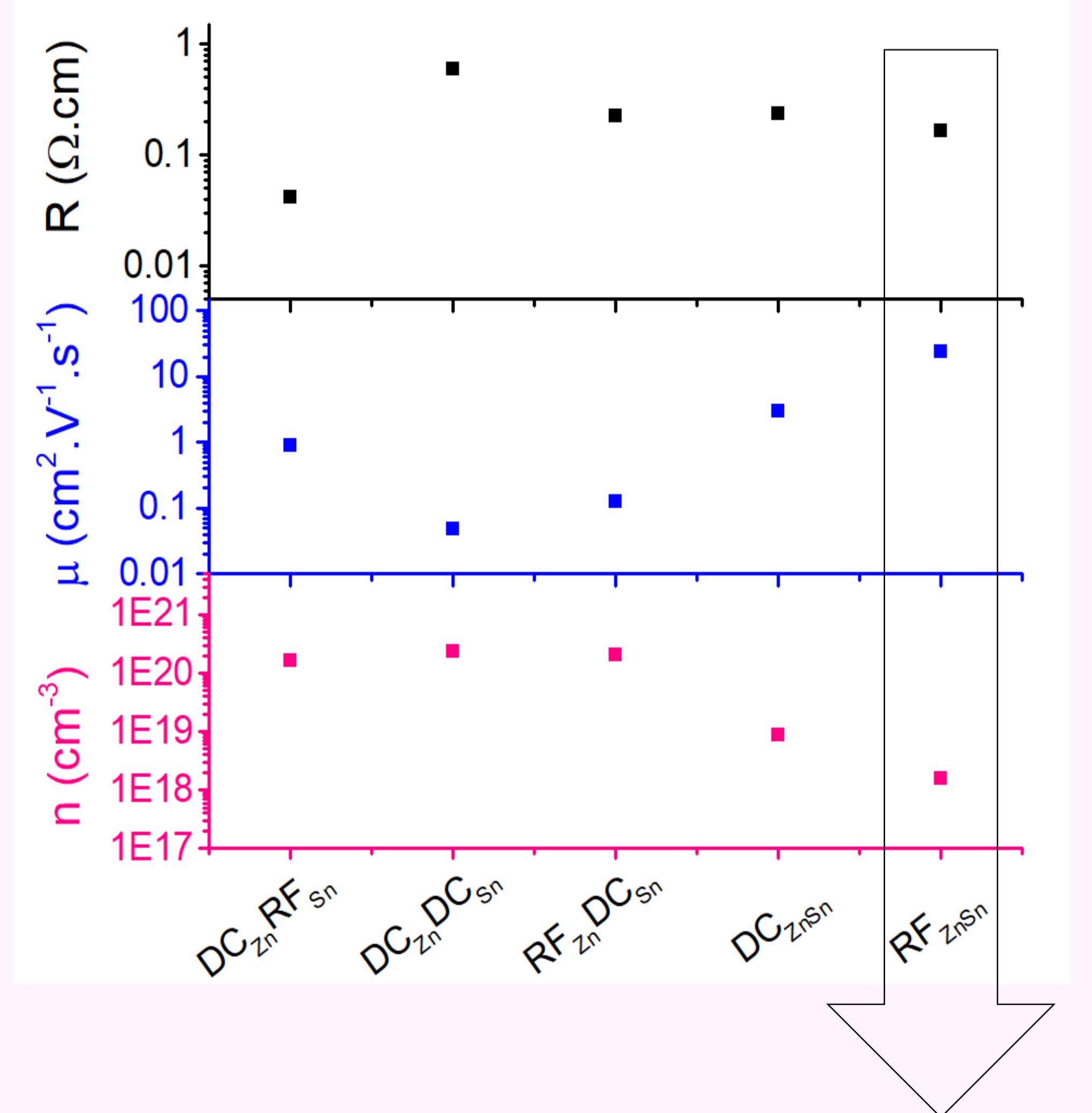


$\text{Zn}/(\text{Zn}+\text{Sn}) \sim 46\%$  for all samples (by EDS)

Optical bandgaps were evaluated using UV-VIS Spectrometer and Tauc's relation



Electrical properties obtained by Hall-Effect measurement system in Van Der Pauw model



DC<sub>Zn</sub>RF<sub>Sn</sub> matches all the characteristic peaks of  $\text{ZnSnN}_2$

## Conclusion

- Sputtering mode (DC, RF) affects the crystalline structure as well as optoelectronic and electrical properties.
- Lowest carrier density ( $1.60 \times 10^{18} \text{ cm}^{-3}$ ) and highest carrier mobility ( $23.7 \text{ cm}^2.\text{V}^{-1}.\text{s}^{-1}$ ) are obtained for RF<sub>ZnSn</sub> sample (gap around 1.6 eV) → photoconductor fabrication is on the way.

