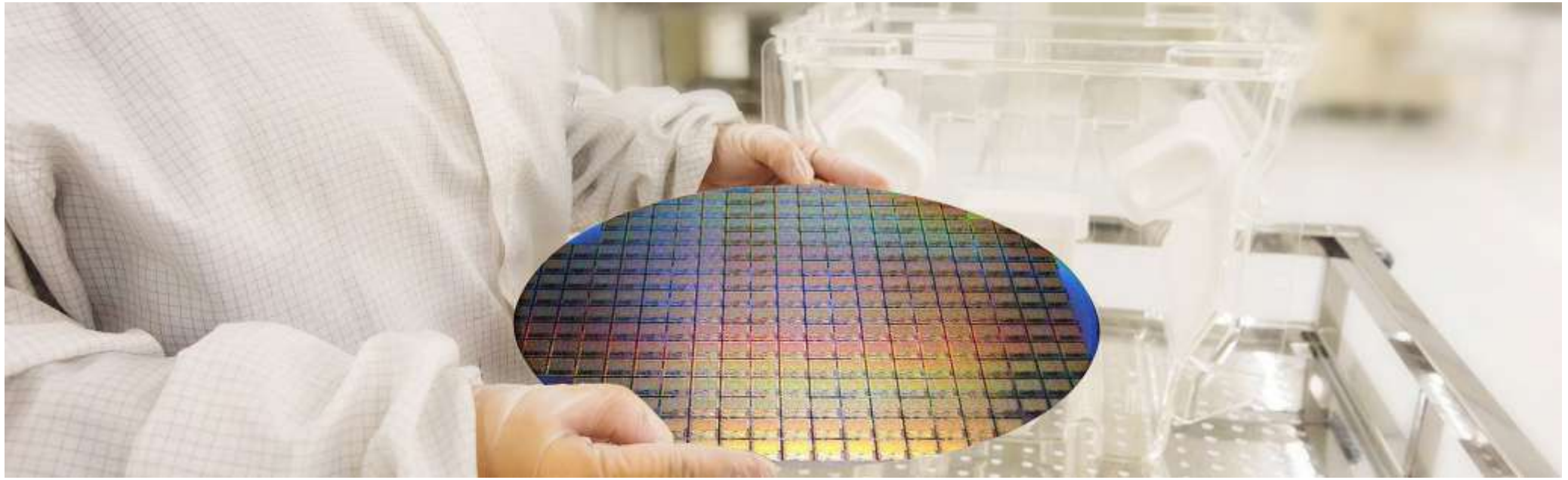
中国科学院上海微系统与信息技术研究所
Shanghai Institute of Microsystem and Information Technology Chinese Academy of Sciences

沉积温度对SCOT光电性能及表面形貌的影响



报告人：刘奕阳　2019.11.23

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SCOT——材料及制备

SCOT成分wt%—In_2O_3：ZrO_2：TiO_2：Ga_2O_3=98.5 : 0.5 : 0.5 : 05

RF-sputter：Ar＋O2　　初始真空：~10^{-4}Pa

功率	溅射压强	氧分压	薄膜厚度	沉积温度
120W	0.45Pa	0.008	70nm＆400nm	RT~160℃

Post annealing：air-200℃ 30min

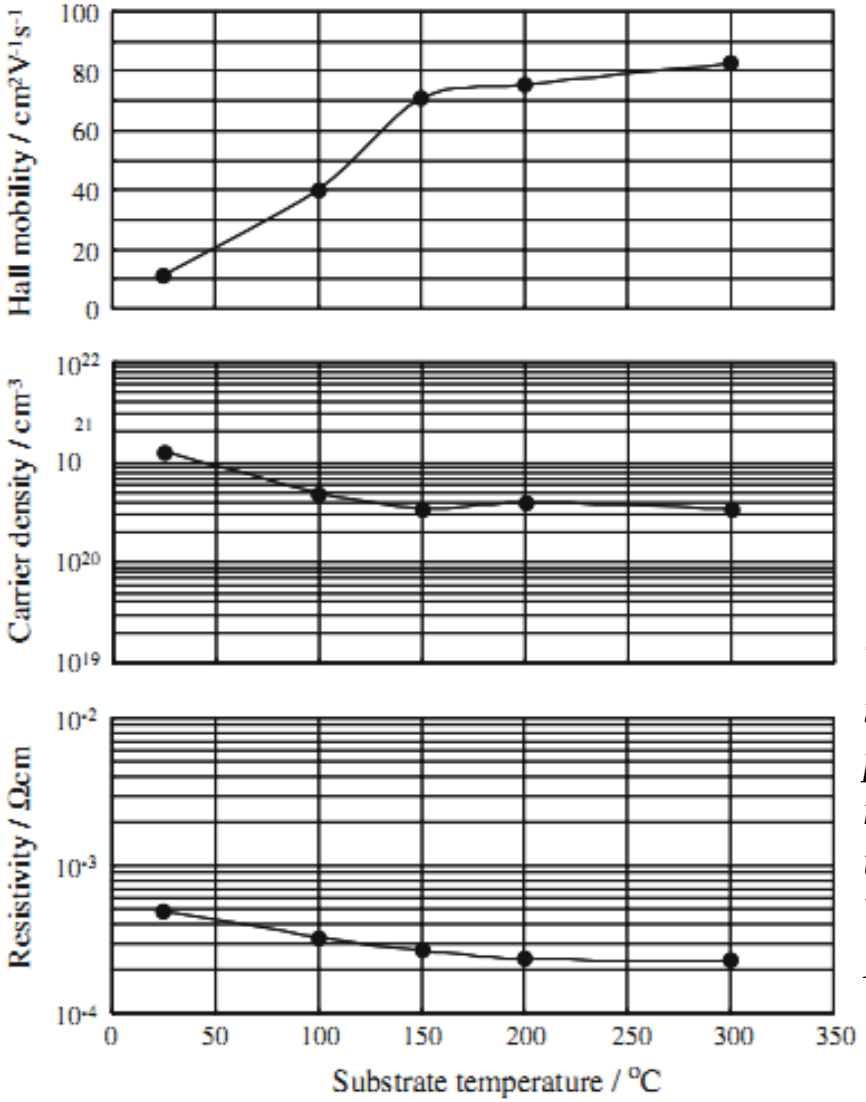


Fig. 4 Substrate temperature dependency of resistivity, carrier density and Hall mobility of ITiO films of 1.6 at.% Ti-doping. Total gas pressure: 0.6 Pa, oxygen content in sputtering gas: 1 vol.%. Film thickness: 500 nm

Titanium-doped indium oxide films prepared by d.c. magnetron sputtering using ceramic target
Yoshiyuki Abe ·Norik Ishiyama

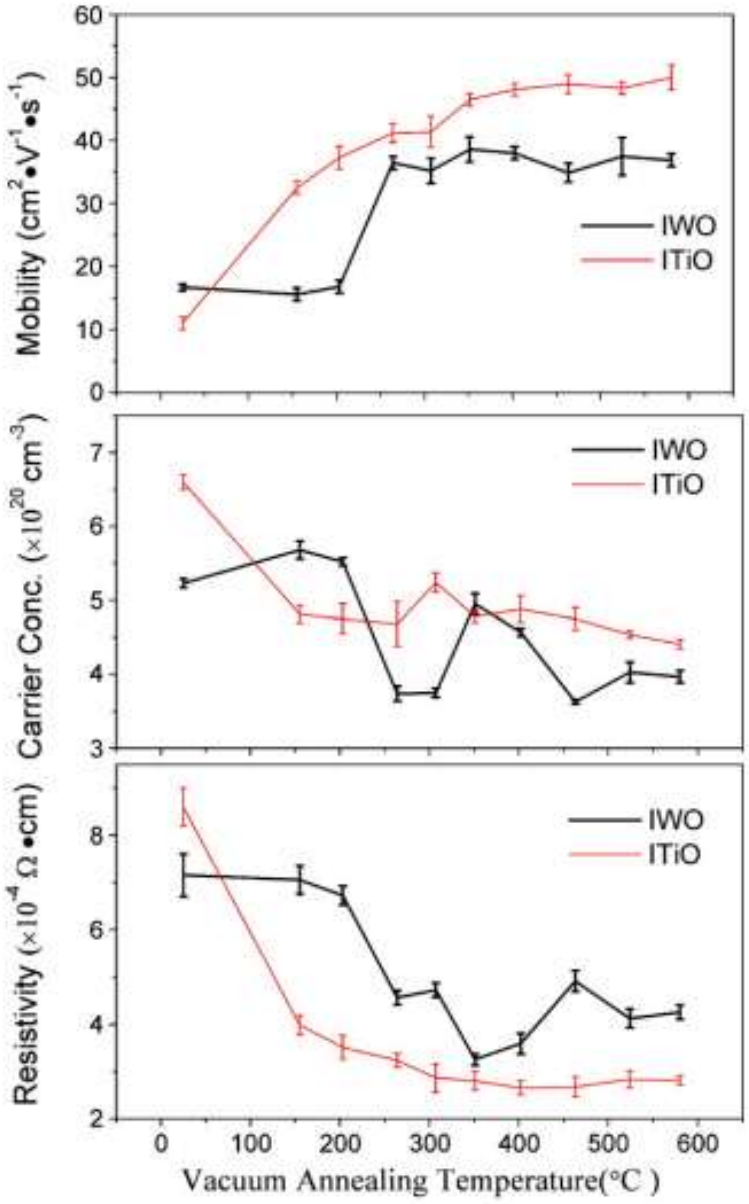
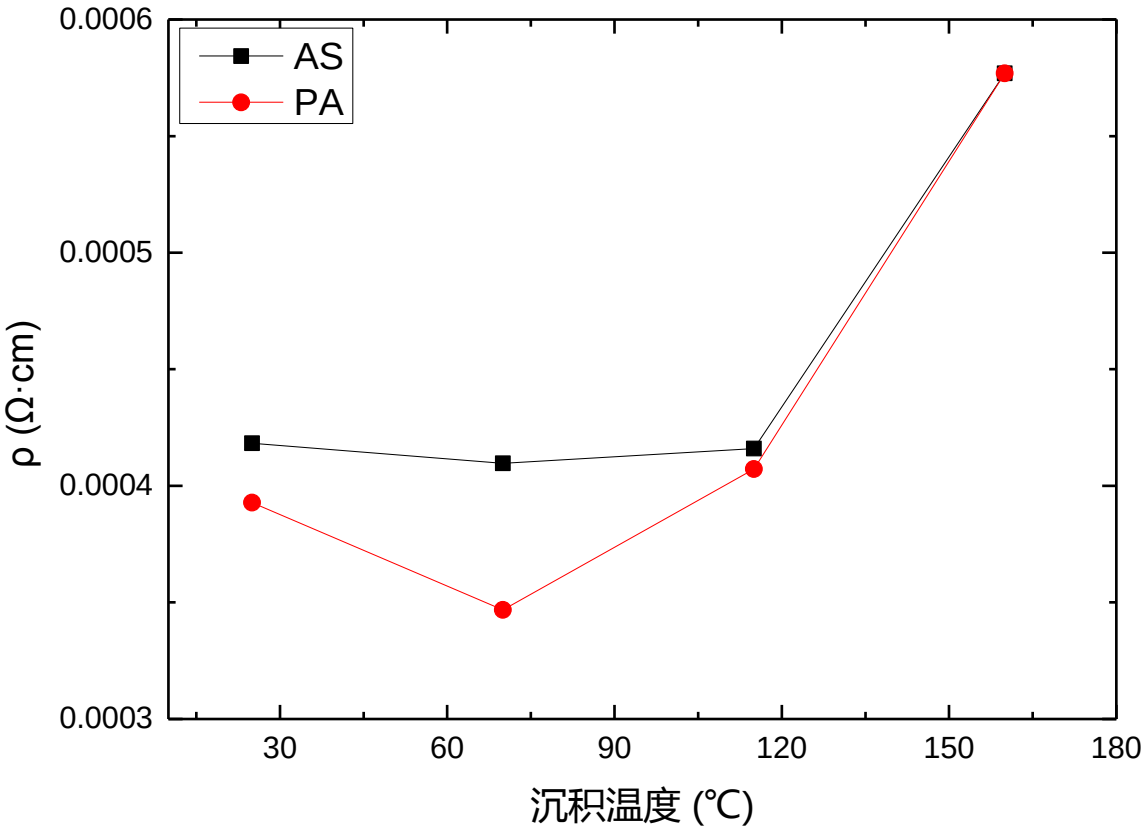
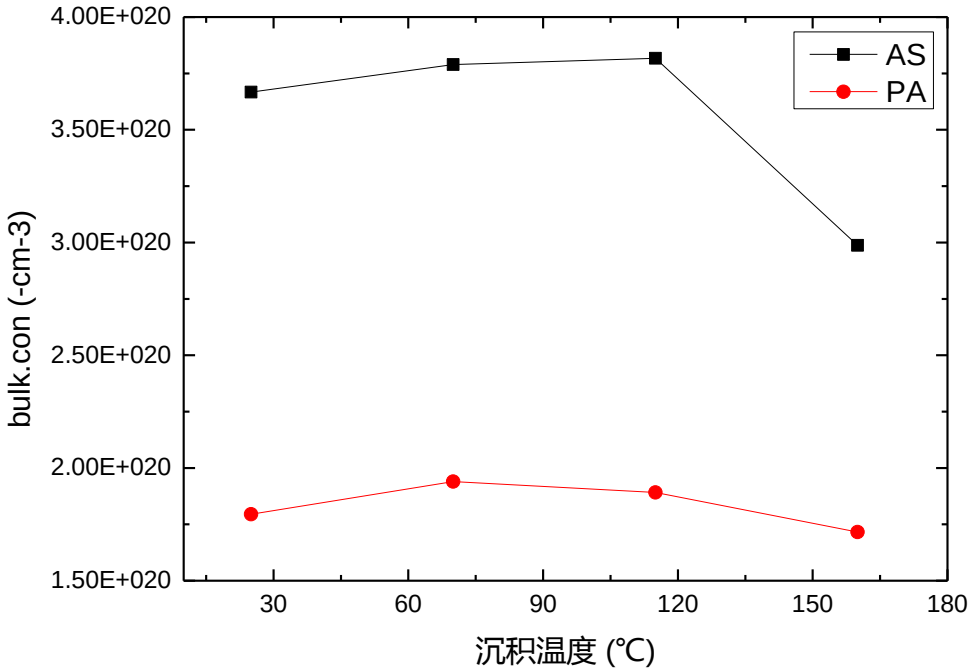


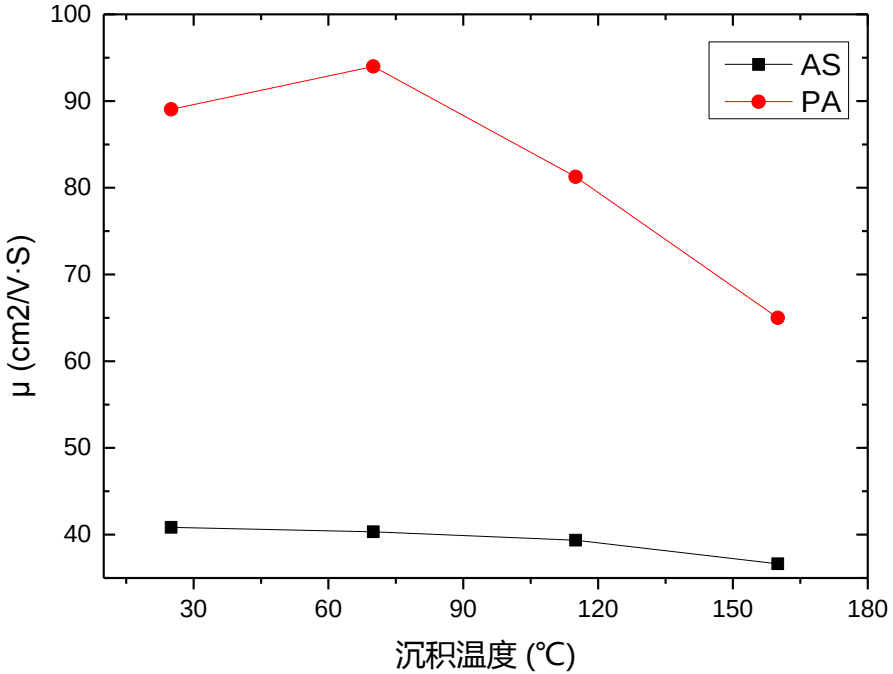
Fig. 4. Effect of post-annealing on the electrical properties of IWO and ITIO films deposited at 20 W for 1 h (error bars reflect the sample to sample variations).

Changes in the structural and electrical properties of vacuum post-annealed tungsten- and titanium-doped indium oxide films deposited by radio frequency magnetron sputtering
L.T. Yan , R.E.I. Schropp

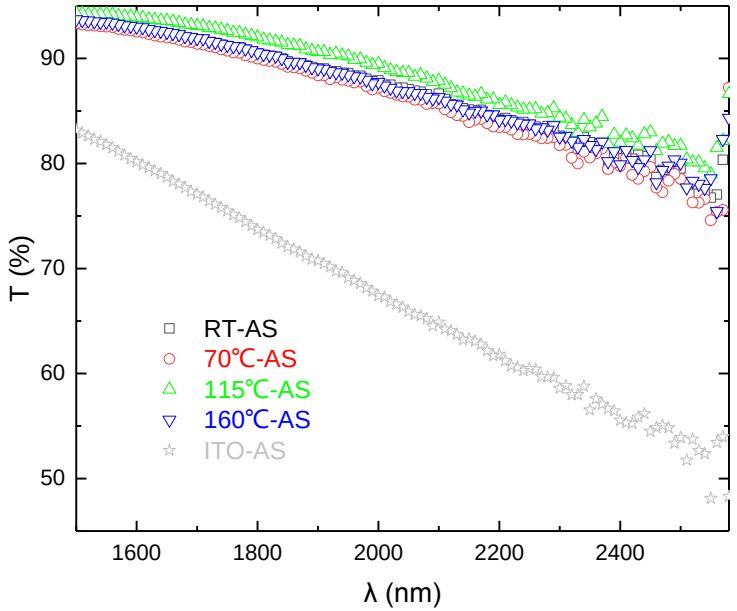
SCOT温度系列-电学性能

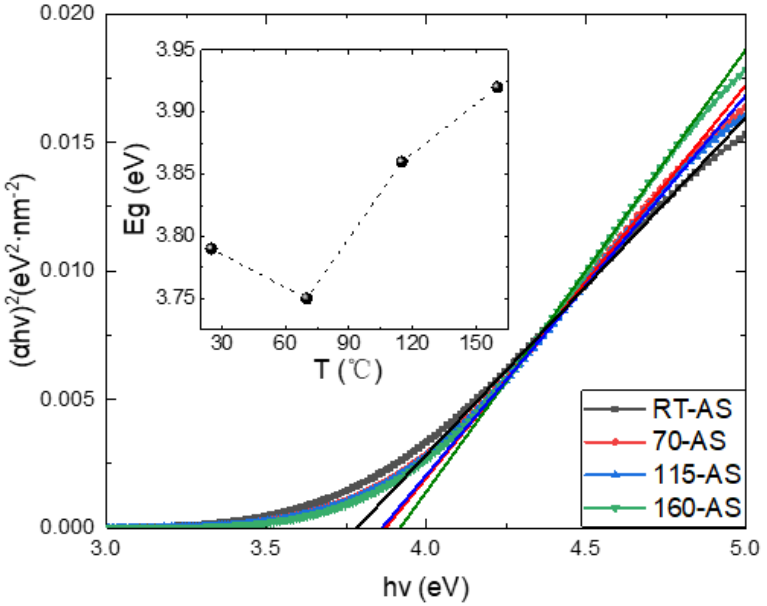


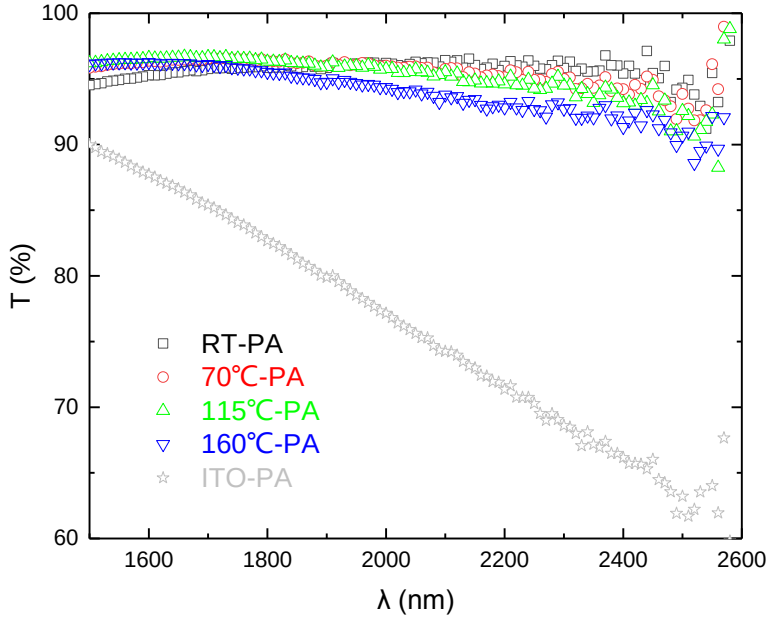


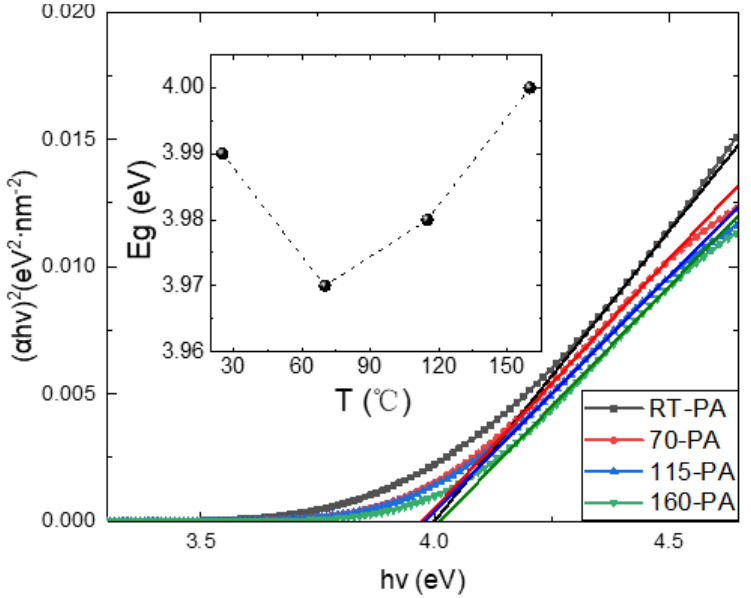


SCOT温度系列-光学性能

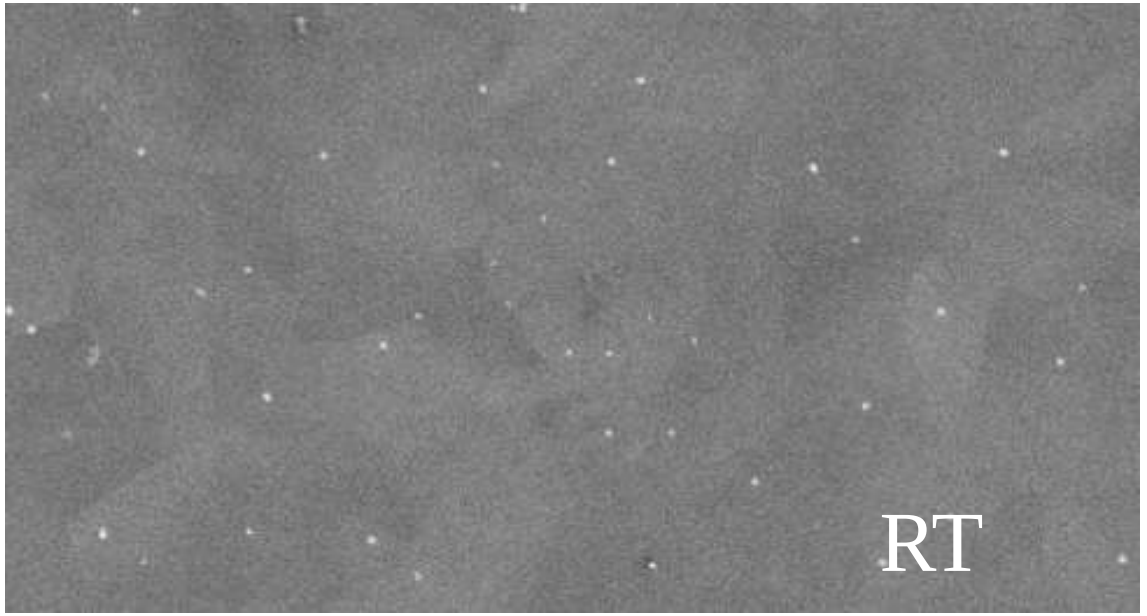


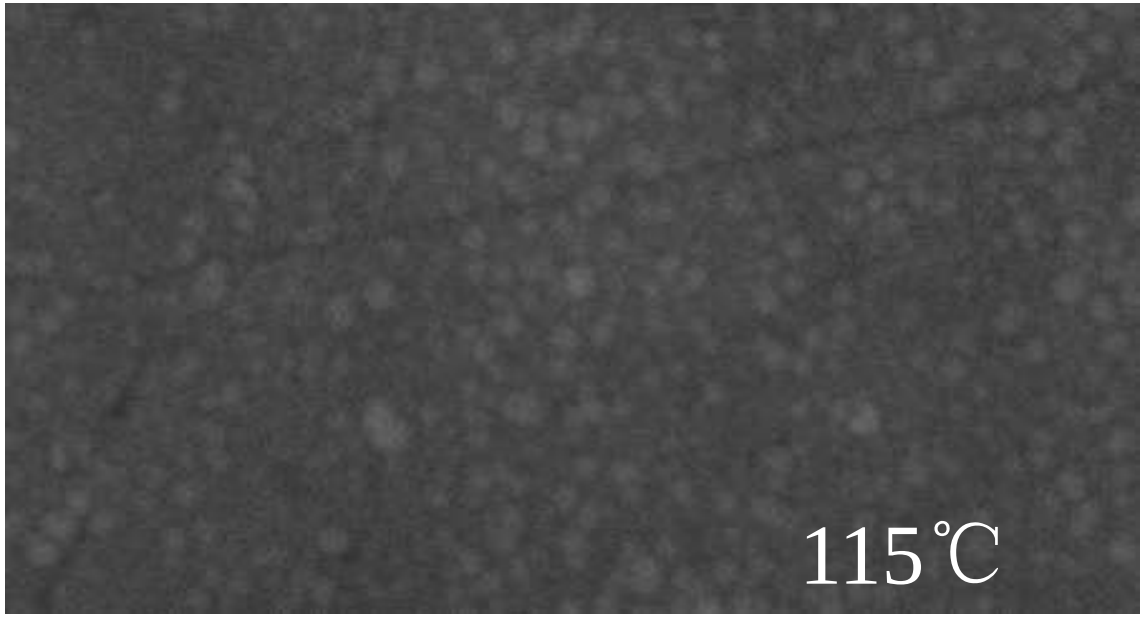


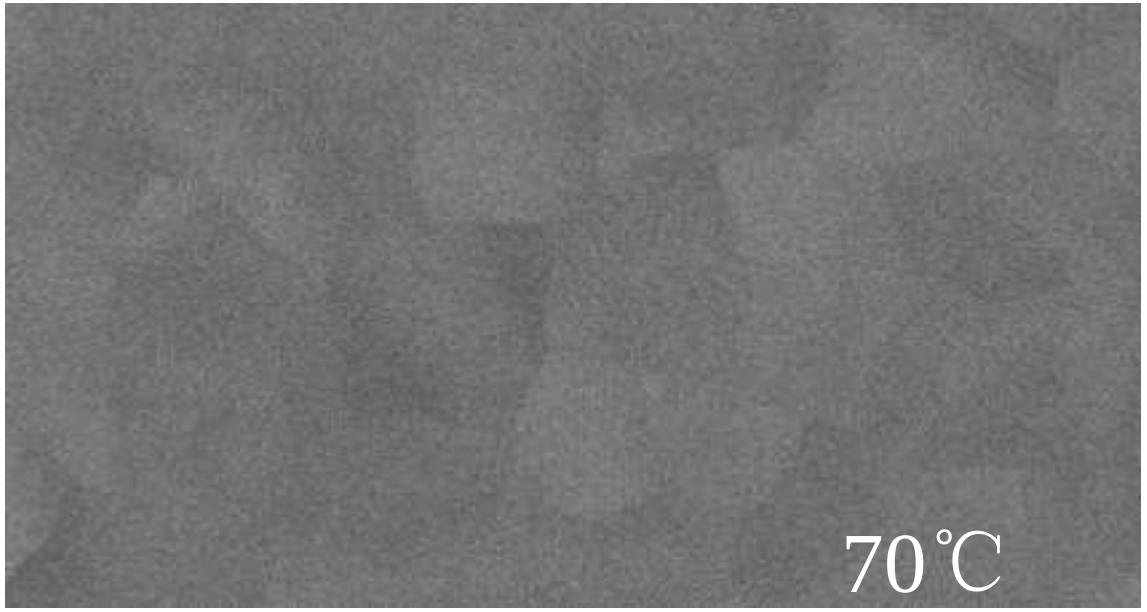


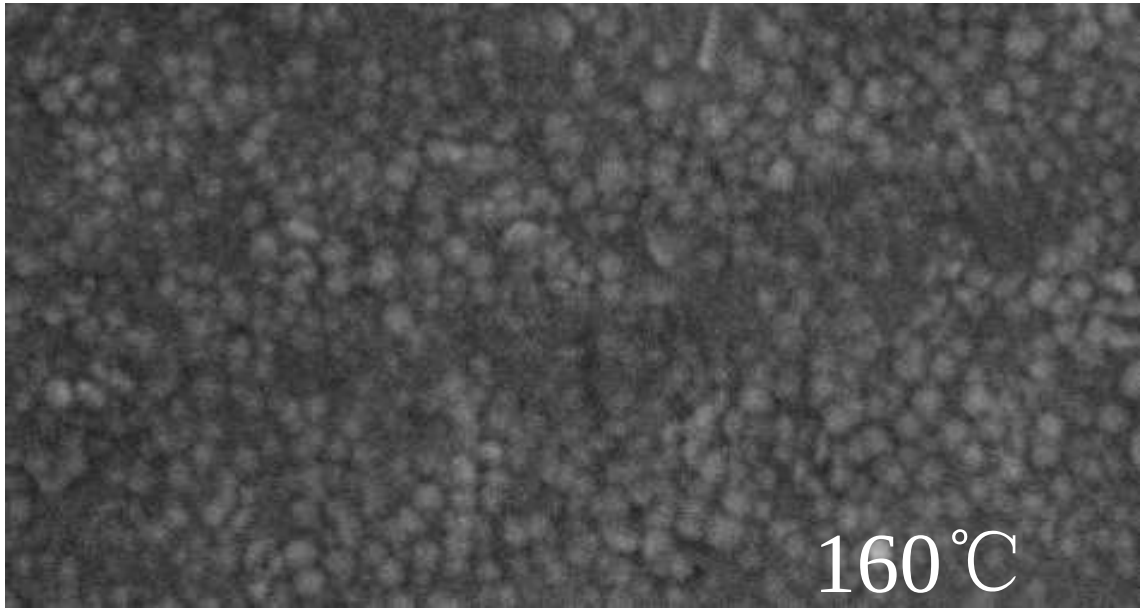


SCOT-SEM-PA-70nm

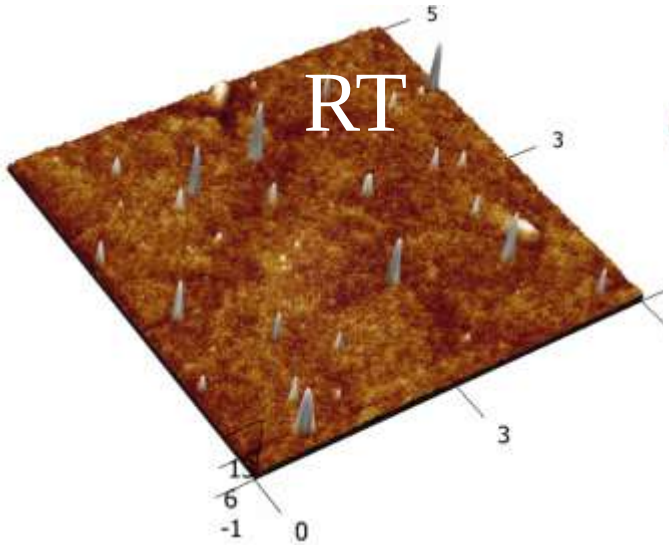


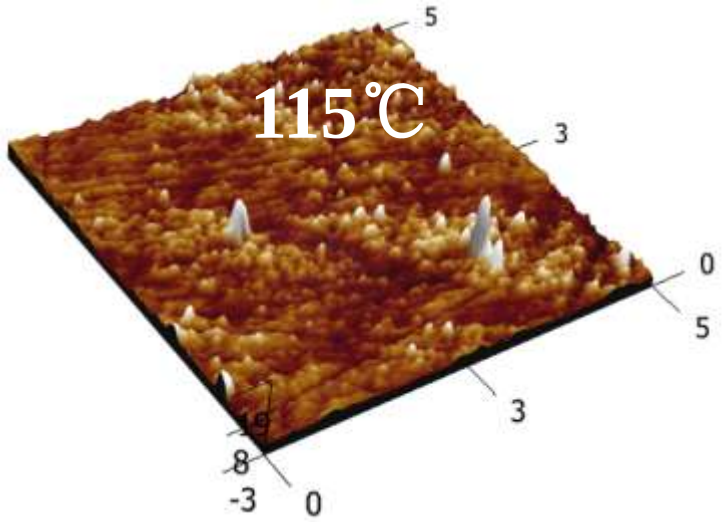


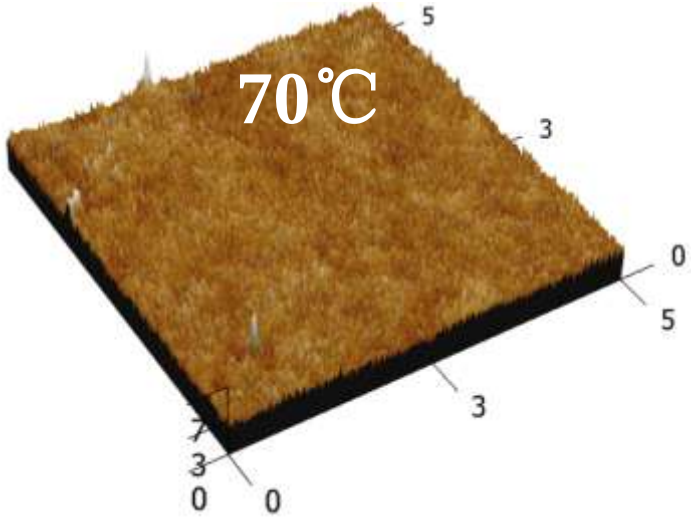


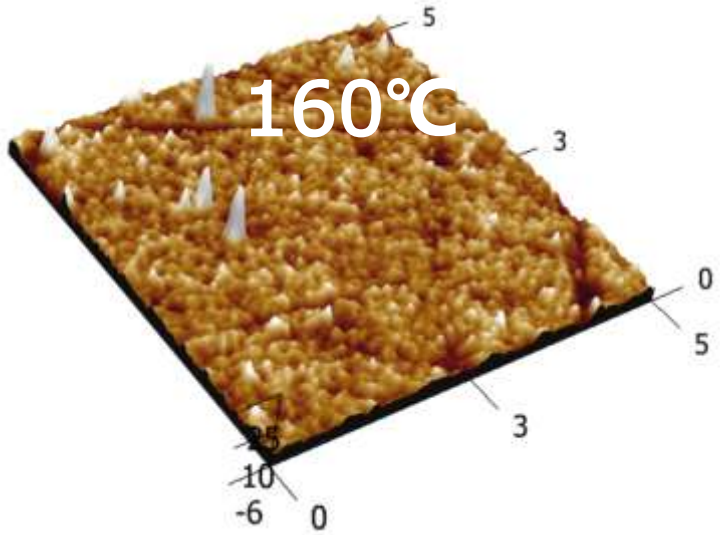


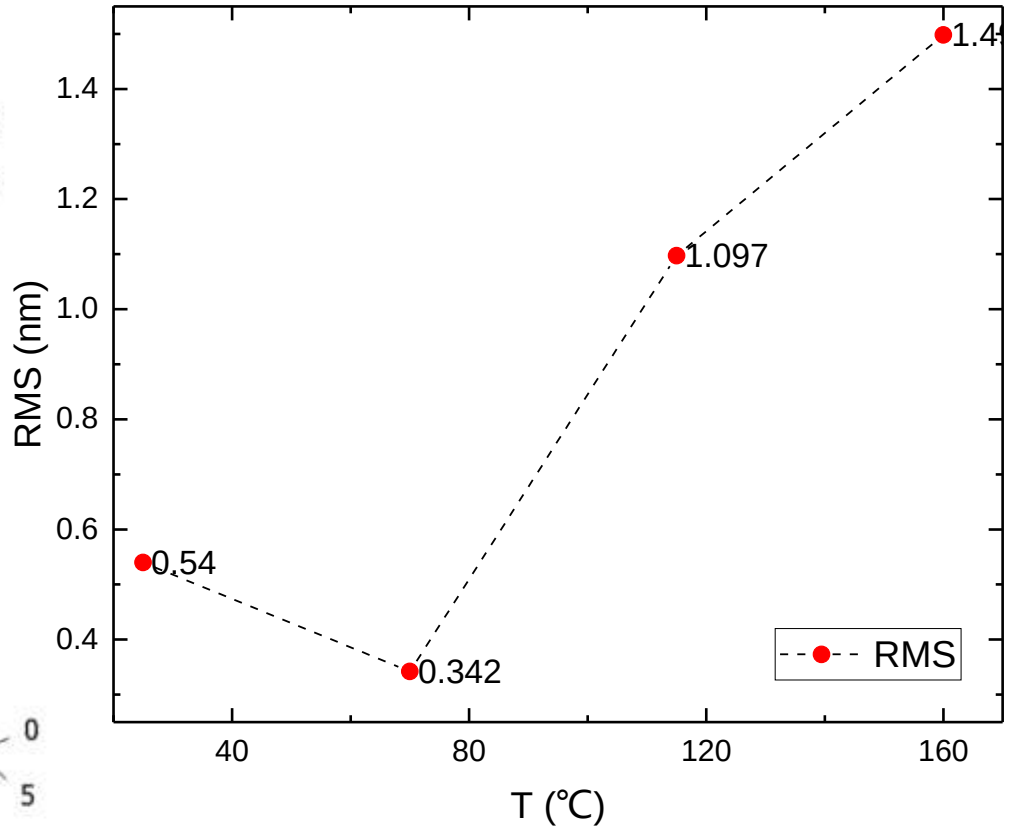
SCOT-AFM-PA



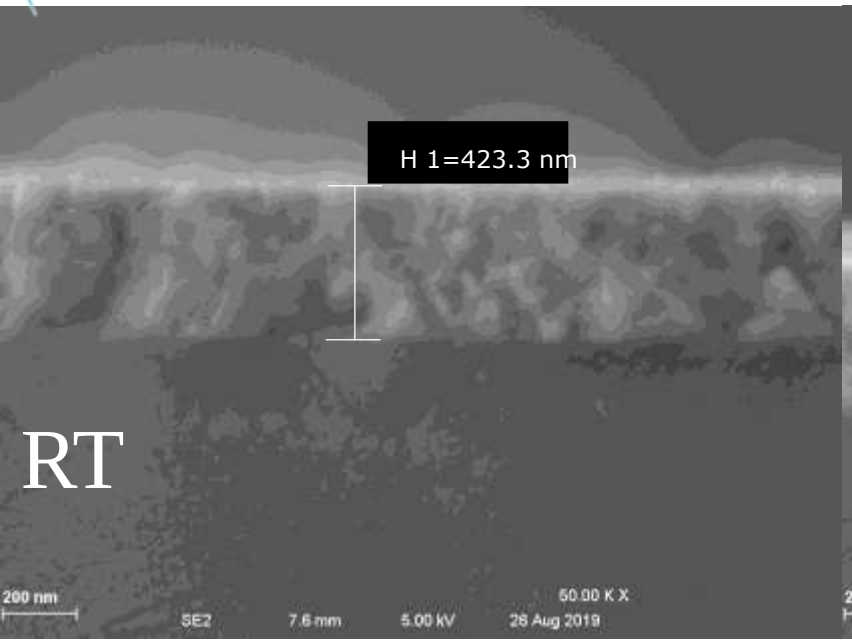


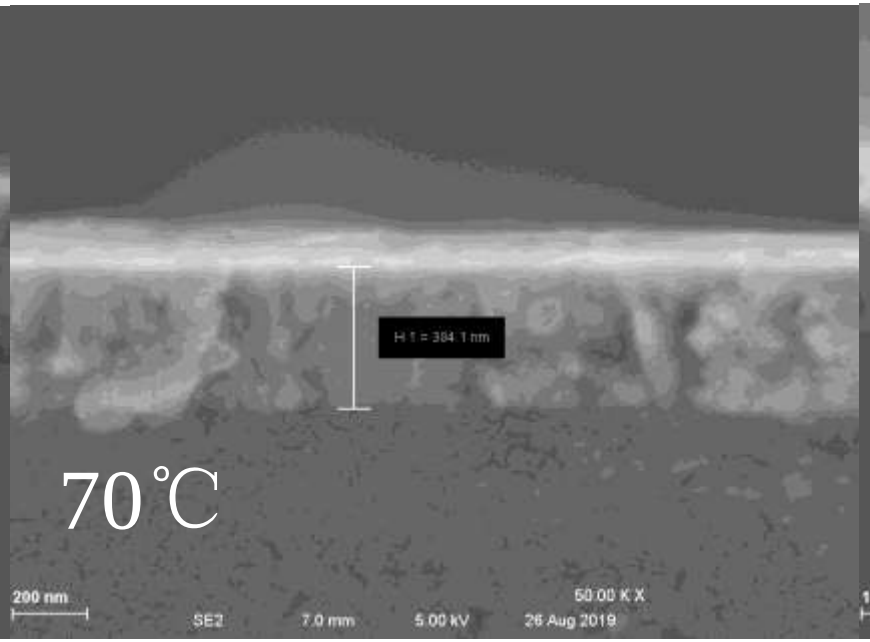


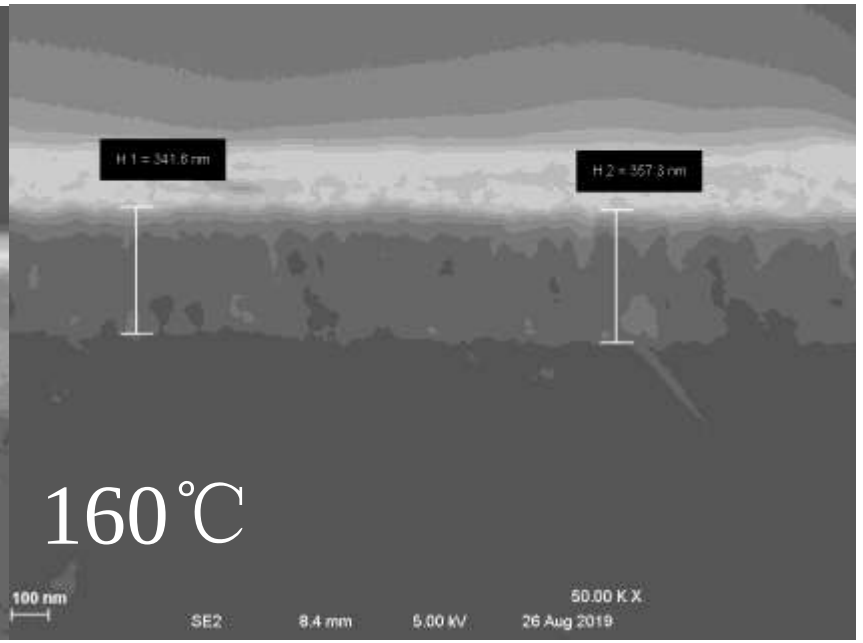


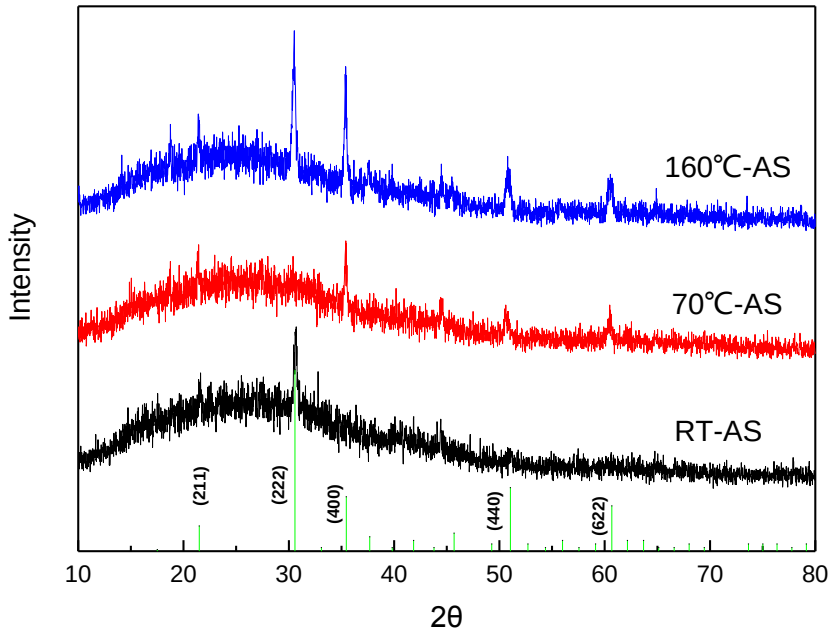


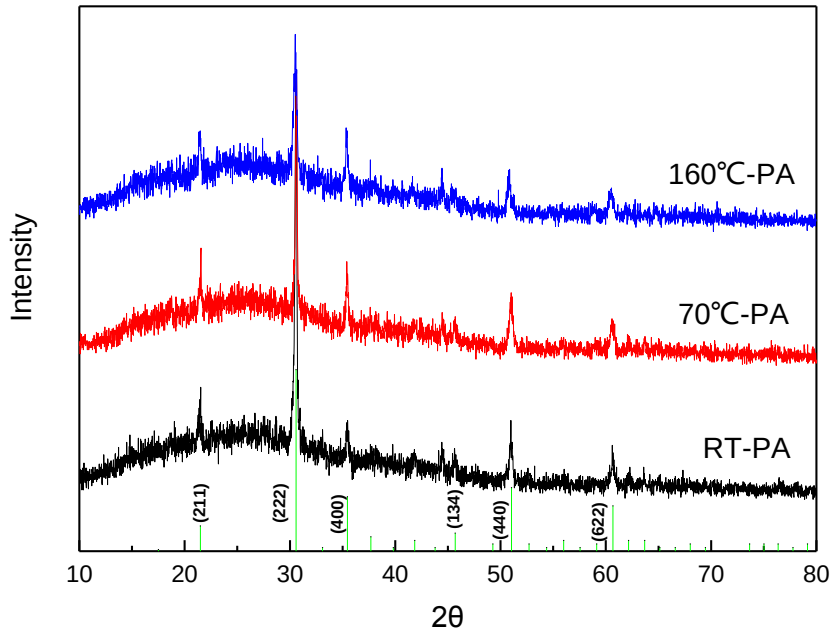
SCOT-SEM&XRD-PA







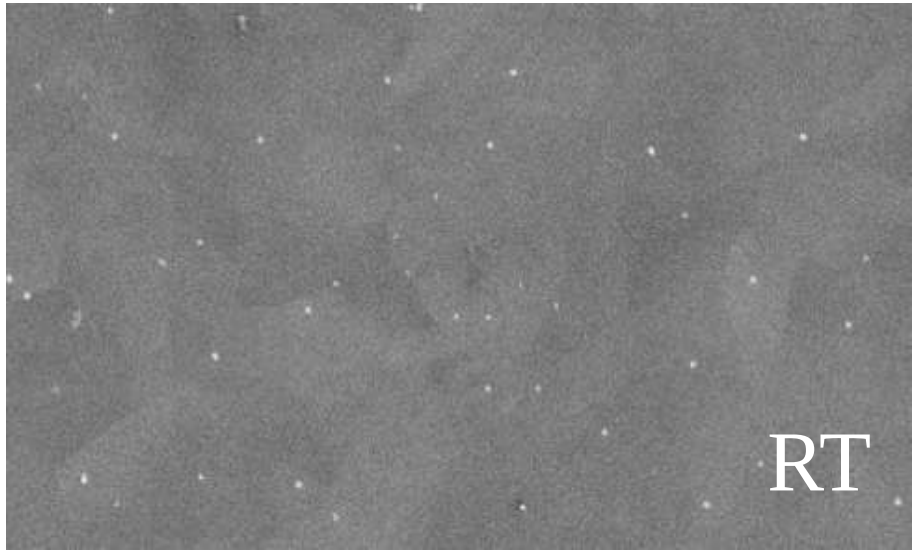




所有薄膜表现出与标准IO一致的晶向；不同沉积温度下，薄膜表现出不同的择优取向，而退火之后择优取向被消除。

关于室温沉积下SCOT薄膜表面白色颗粒的分析

颗粒尺寸太小，直接表征困难，EDS结果不理想，XPS、SIMS无法探测

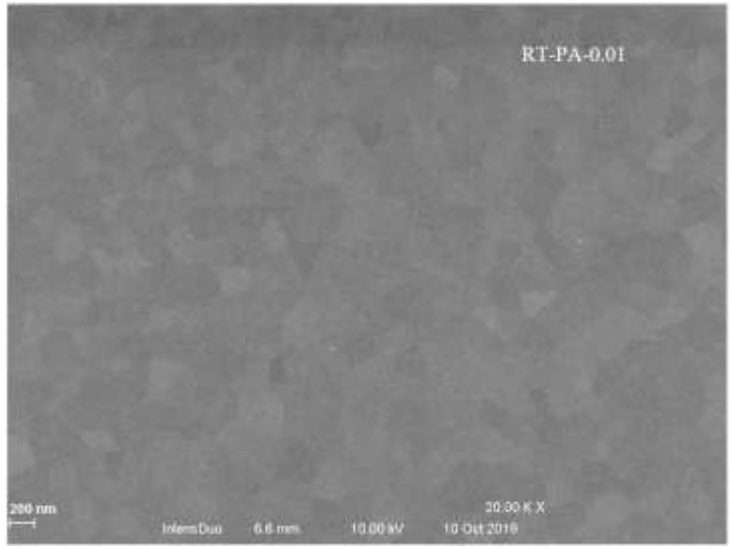


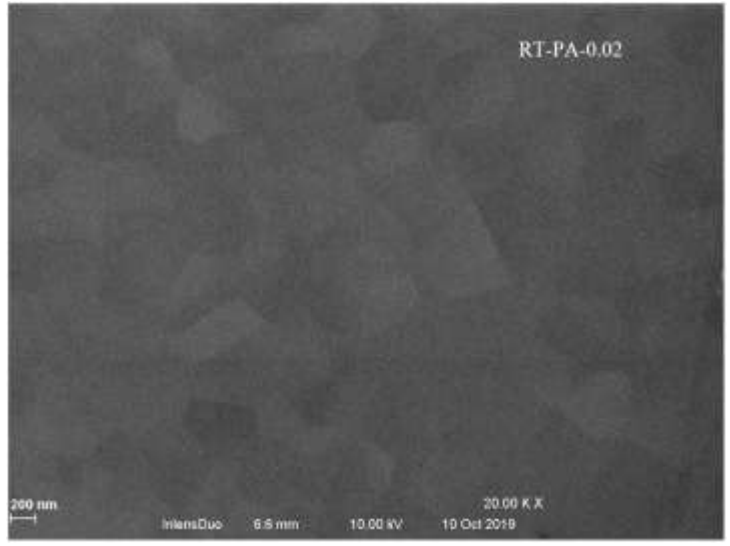
元素种类	熔点	沸点
In	156.61℃	2060℃
Zr	1852±2℃	4377℃
Ti	1668℃	3287℃
Ga	29.8℃	2403℃

RT＜29.8℃＜70℃＜115℃＜160℃

四种元素的金属活动性顺序：Ti＞Zr＞Ga＞In

熔化→析出→蒸发





总结

1、SCOT电学性能随温度升高先增强再降低，而且具有不同于传统TCO材料的低温特性；

2、相对于主流的ITO，SCOT在长波段的透过性表现优秀；

3、温度对SCOT薄膜表面的粗糙程度影响很大；

4、结晶质量越好，光学带隙越小；

5、氧不足和低温同时存在的情况下，会影响SCOT中Ga元素的有效掺杂；

6、高温沉积使薄膜更致密。

Thank you !