

Effect of Heat Treatment on Properties of Sputtered $\text{Co}_{100-x}\text{Cu}_x$ Film



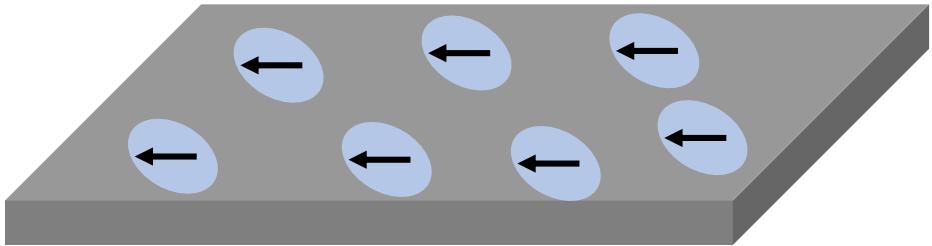
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OUTLINE

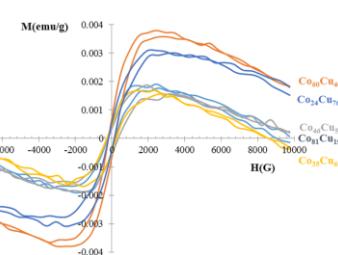
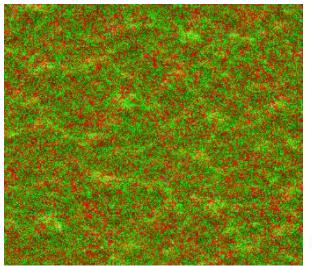
INTRODUCTION



EXPERIMENTAL PROCEDURES

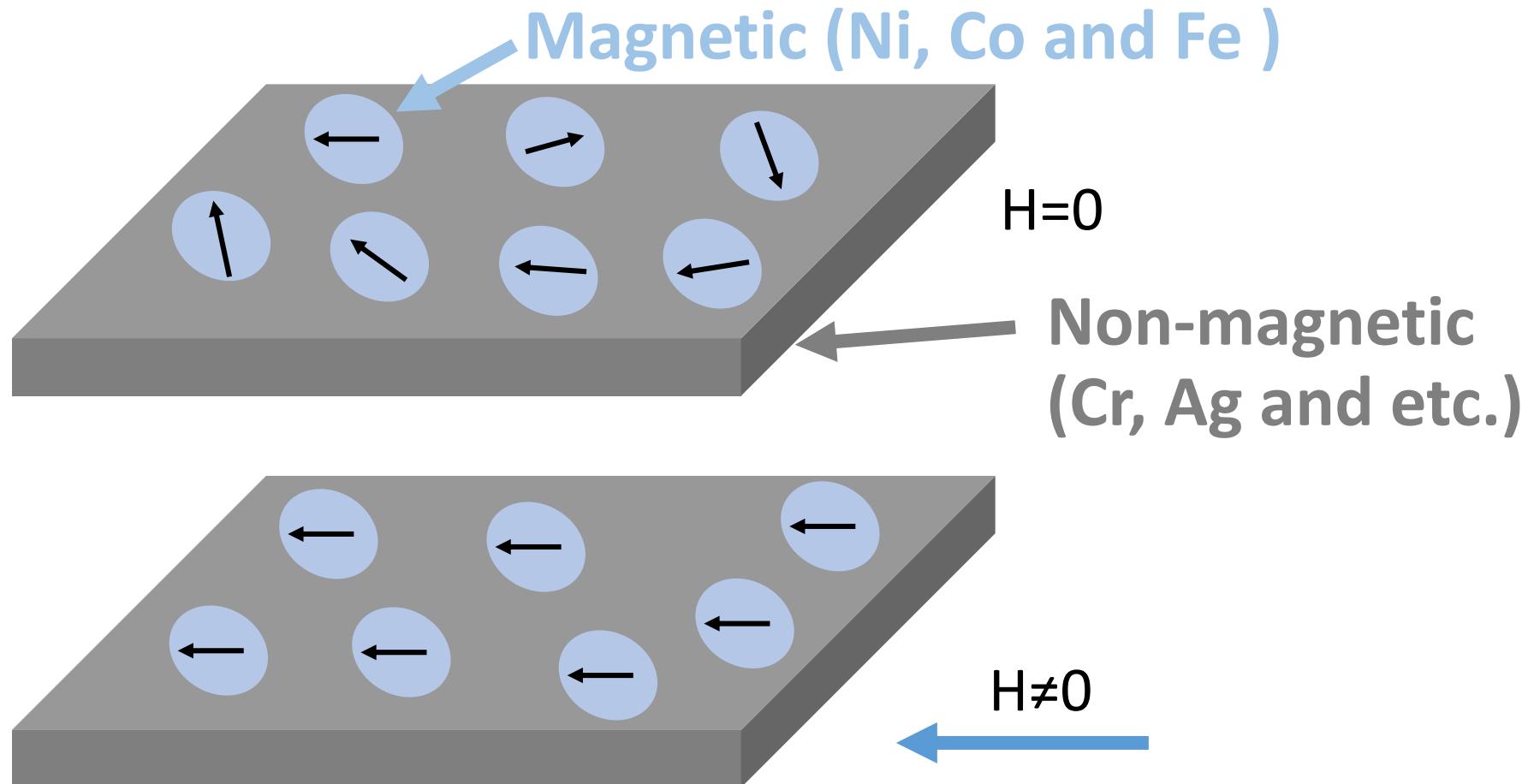


RESULTS AND DISCUSSION



CONCLUSIONS

Granular magnetic films



Introduction

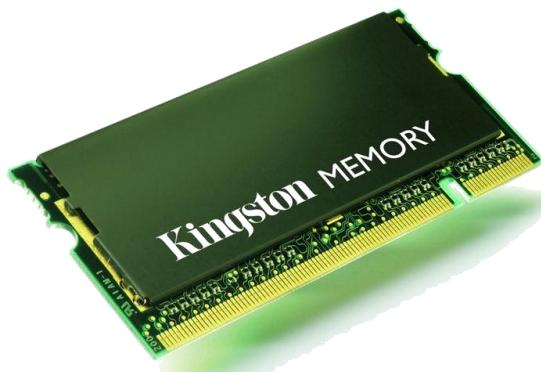
Applications

Hard disk head



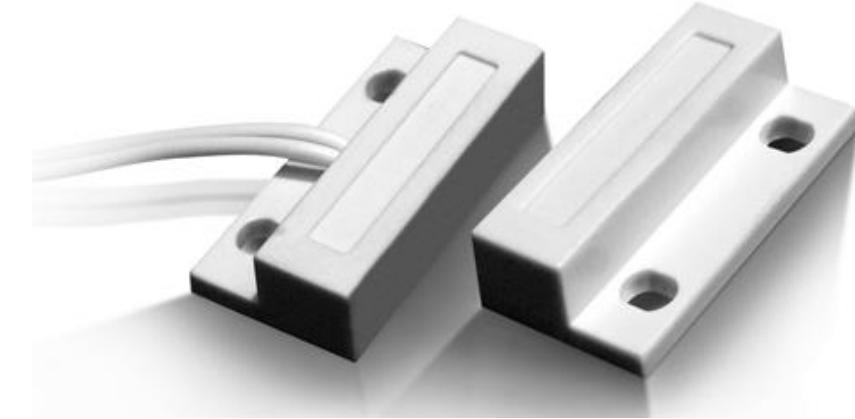
<http://wordpress.mrreid.org/wp-content/uploads/2009/02/hard-disk-platter-and-head.jpg>

Memory



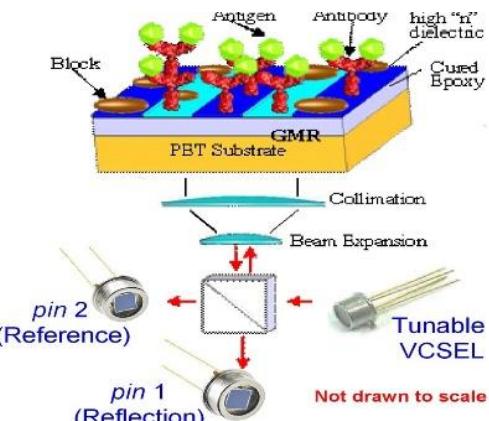
http://img.tarad.com/shop/a/allaboutmemory/img-lib/spd_2007072162032_b.jpg

Magnetic sensor



<http://www.entrypass.net/w3v1/sites/default/files/product-accessories-magnetic-door-sensor-panel.png>

Biosensors

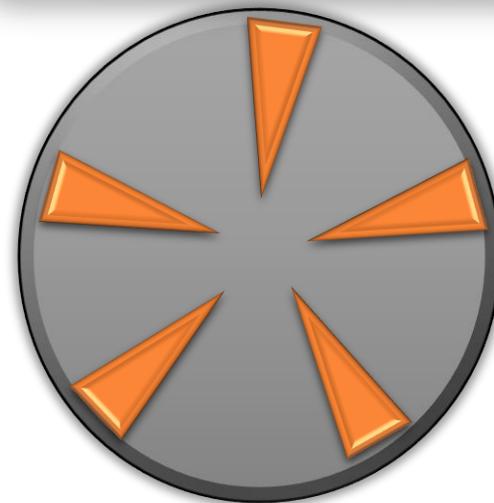


<http://image.slidesharecdn.com/gmr-130616115630-phpapp02/95/gmr-20-638.jpg?cb=1371383851>

**Effect of heat treatment on the morphological,
structural and magnetic properties of CoCu film**

Experimental procedure

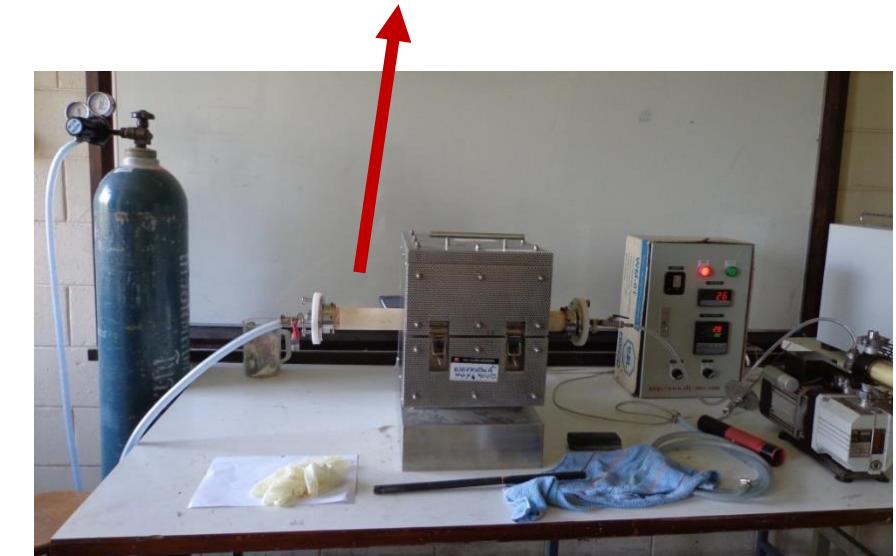
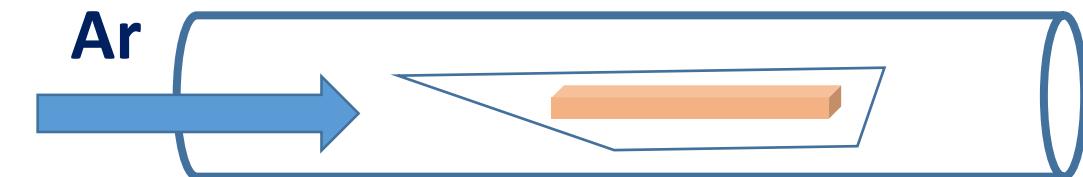
RF-sputtering 250 W
 1.0×10^{-5} mbar
in Argon 90 min



The $\text{Co}_{100-x}\text{Cu}_x$ thin films
Glass substrate



400 °C for 30 min
Ar atmosphere



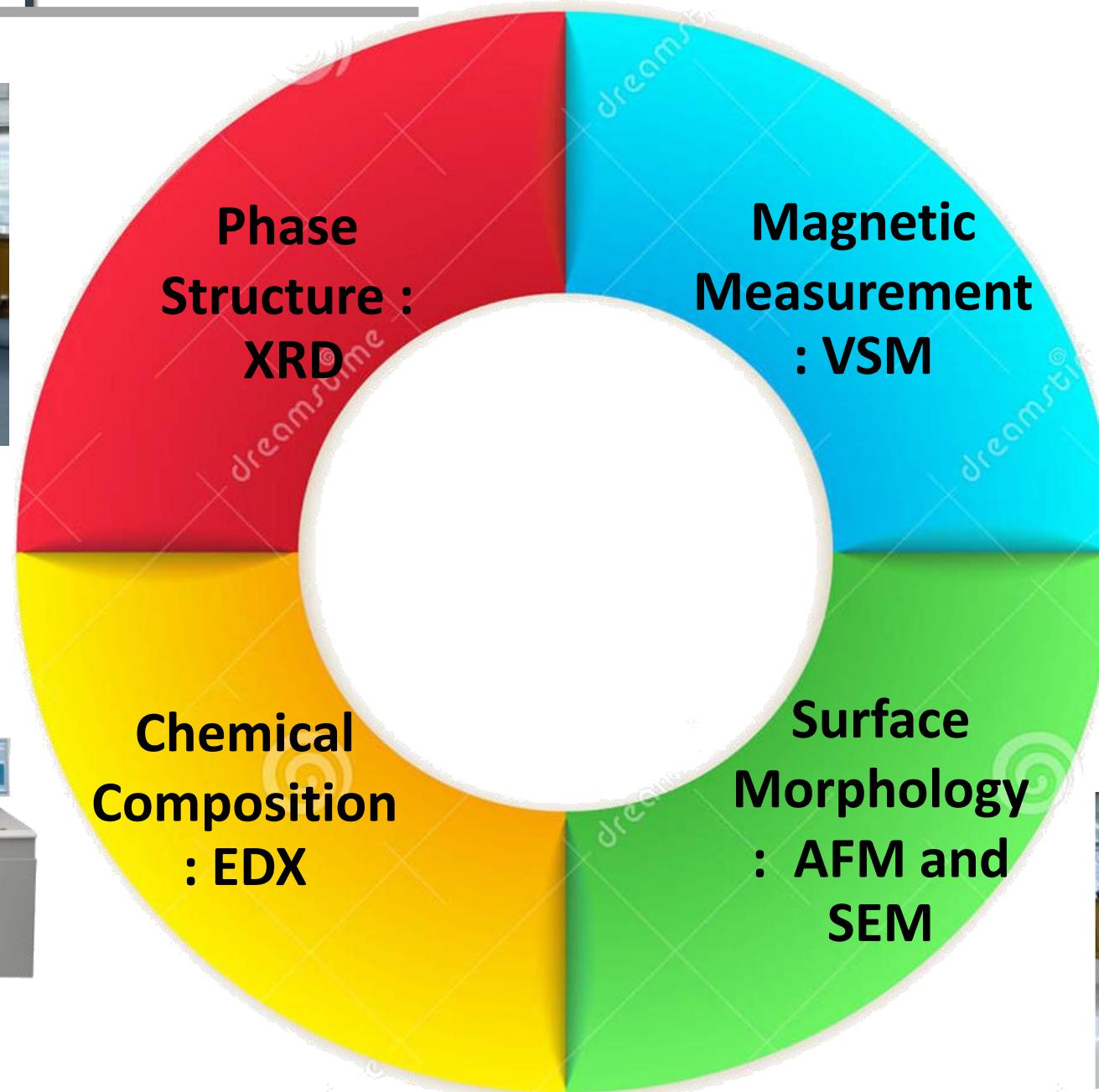
Experimental procedure



<http://www.sci.ku.ac.th:8000/th/sec/index.php/instruments/117-xrd.html>



<http://roilbilad.files.wordpress.com/2010/10/sem.jpg>



http://prv.nrct.go.th/shopping/home/show_product.php?research_id=439



Results and Discussion



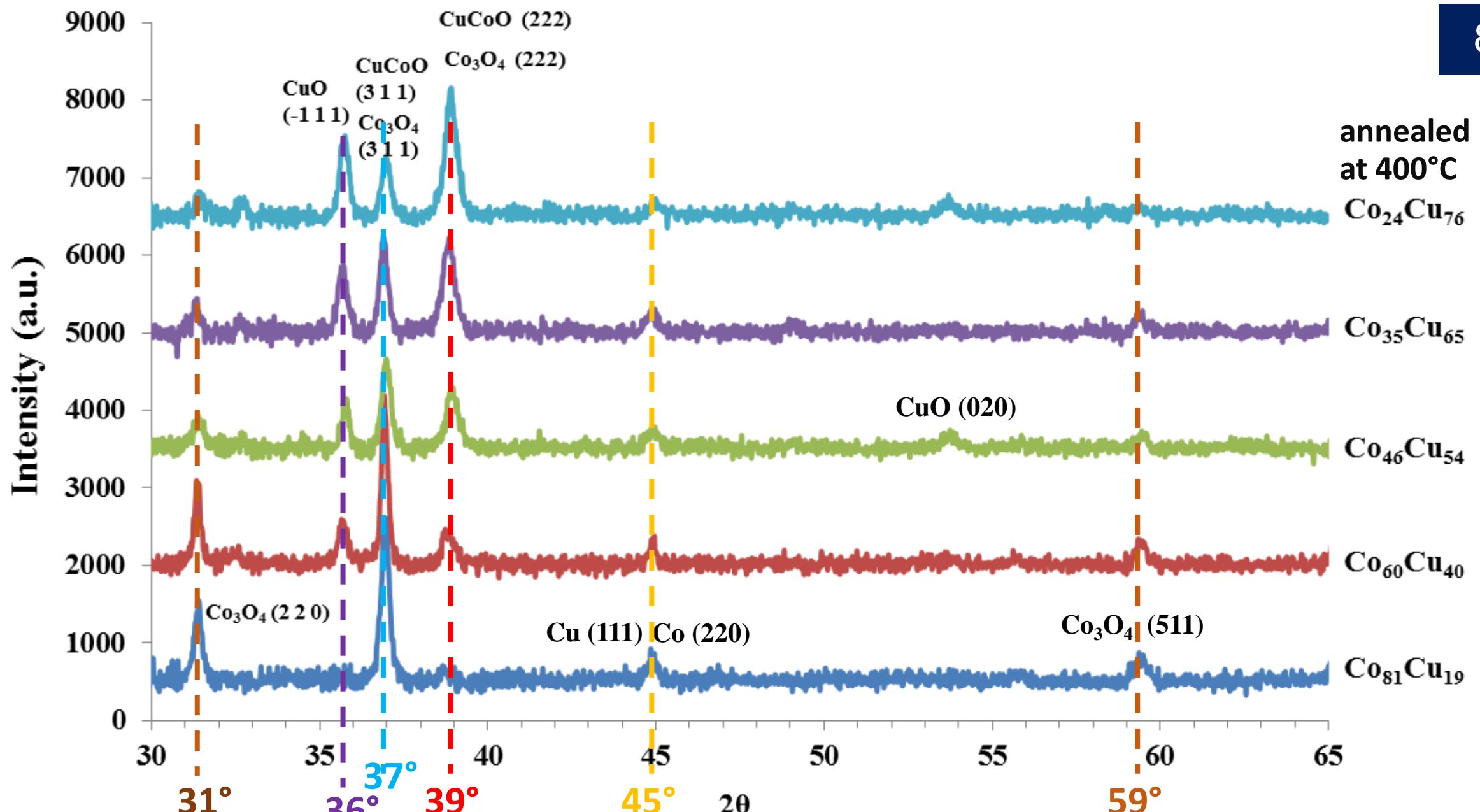


Fig. 1 Phase Structure of annealed Co-Cu thin films from XRD

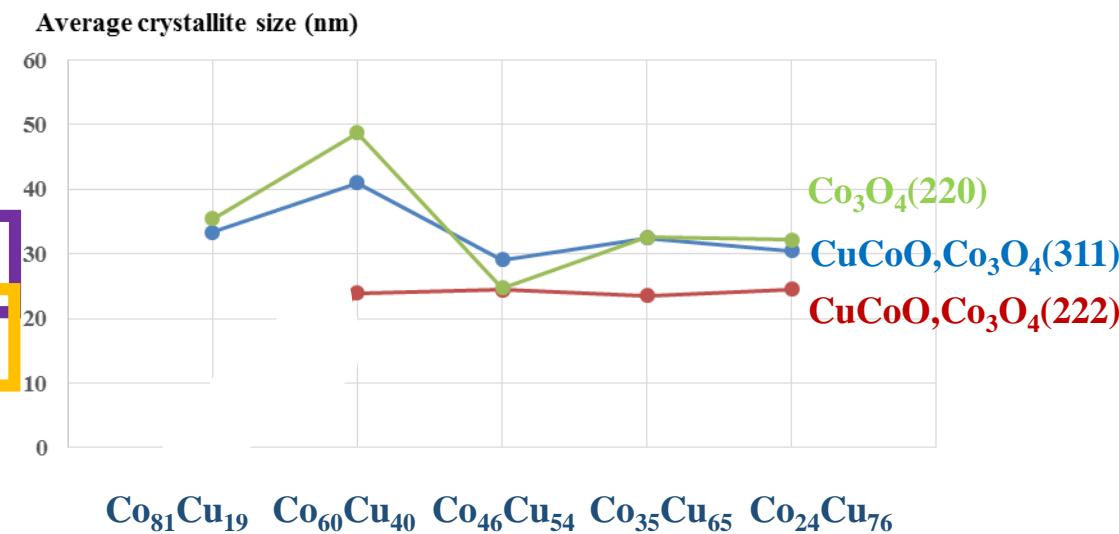
Scherrer's Equation

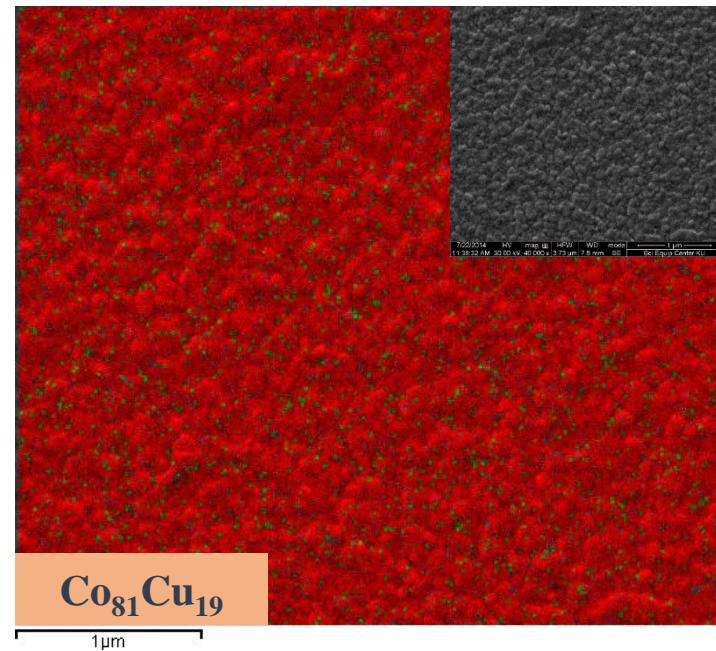
$$D = \frac{0.9\lambda}{\beta \cos \theta}$$

Average crystallite size → FWHM ← Wave length of X-Ray

Angle of Bragg's diffraction

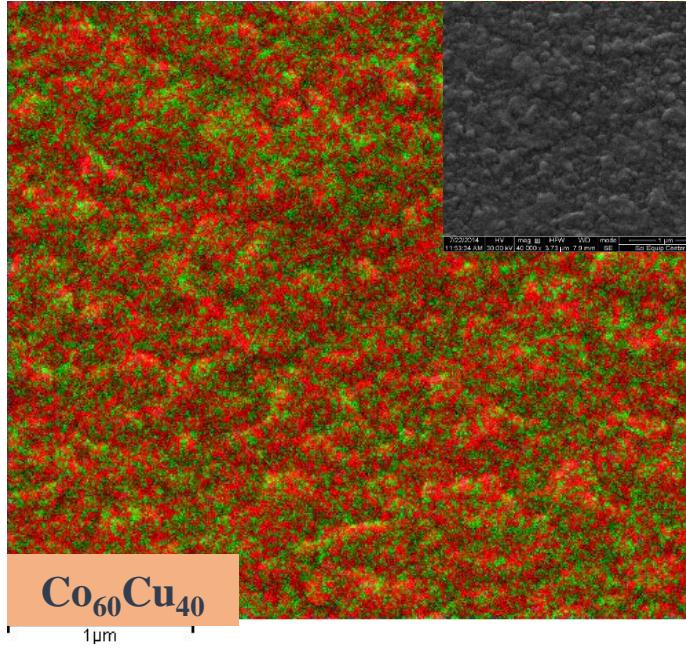
Films	Average crystallite size (nm)		
	CuCoO, Co_3O_4 (311)	CuCoO, Co_3O_4 (222)	Co_3O_4 (220)
$\text{Co}_{81}\text{Cu}_{19}$	33.39	-	35.48
$\text{Co}_{60}\text{Cu}_{40}$	41.05	23.98	48.78
$\text{Co}_{46}\text{Cu}_{54}$	29.14	24.38	24.70
$\text{Co}_{35}\text{Cu}_{65}$	32.45	23.56	32.56
$\text{Co}_{24}\text{Cu}_{76}$	30.50	24.56	32.16





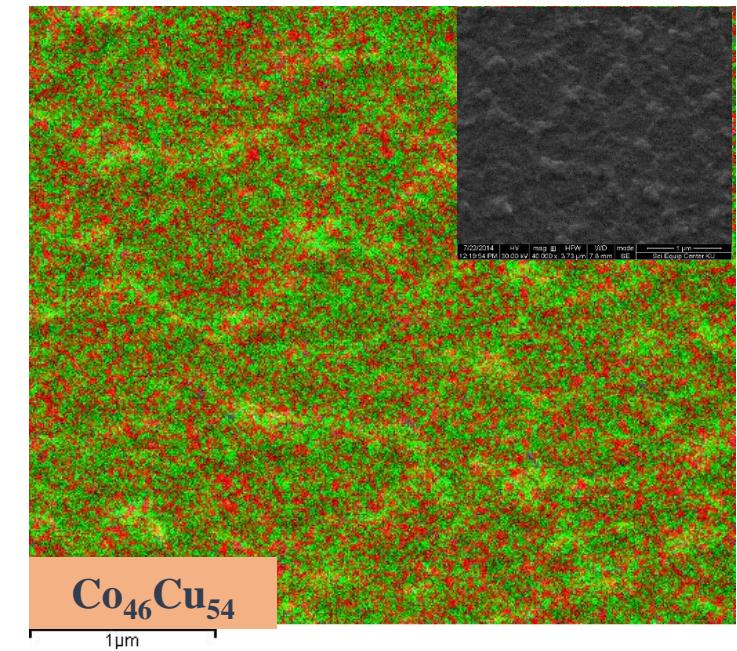
$\text{Co}_{81}\text{Cu}_{19}$

1μm



$\text{Co}_{60}\text{Cu}_{40}$

1μm

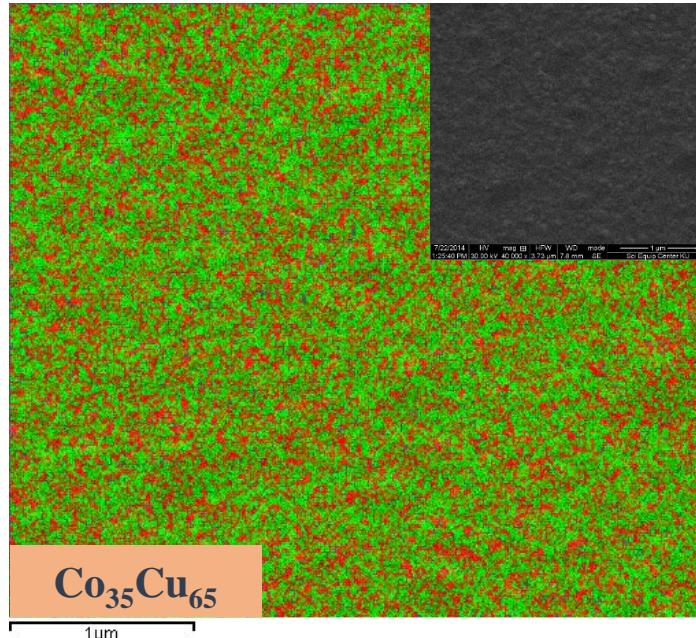


$\text{Co}_{46}\text{Cu}_{54}$

1μm

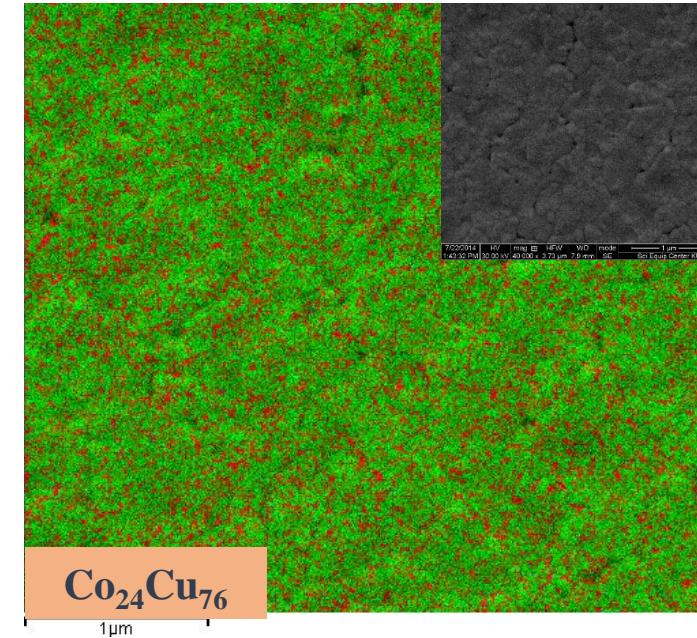
● Co atom

● Cu atom



$\text{Co}_{35}\text{Cu}_{65}$

1μm



$\text{Co}_{24}\text{Cu}_{76}$

1μm

Fig. 2 Mapping result of annealed Co-Cu thin films from EDX

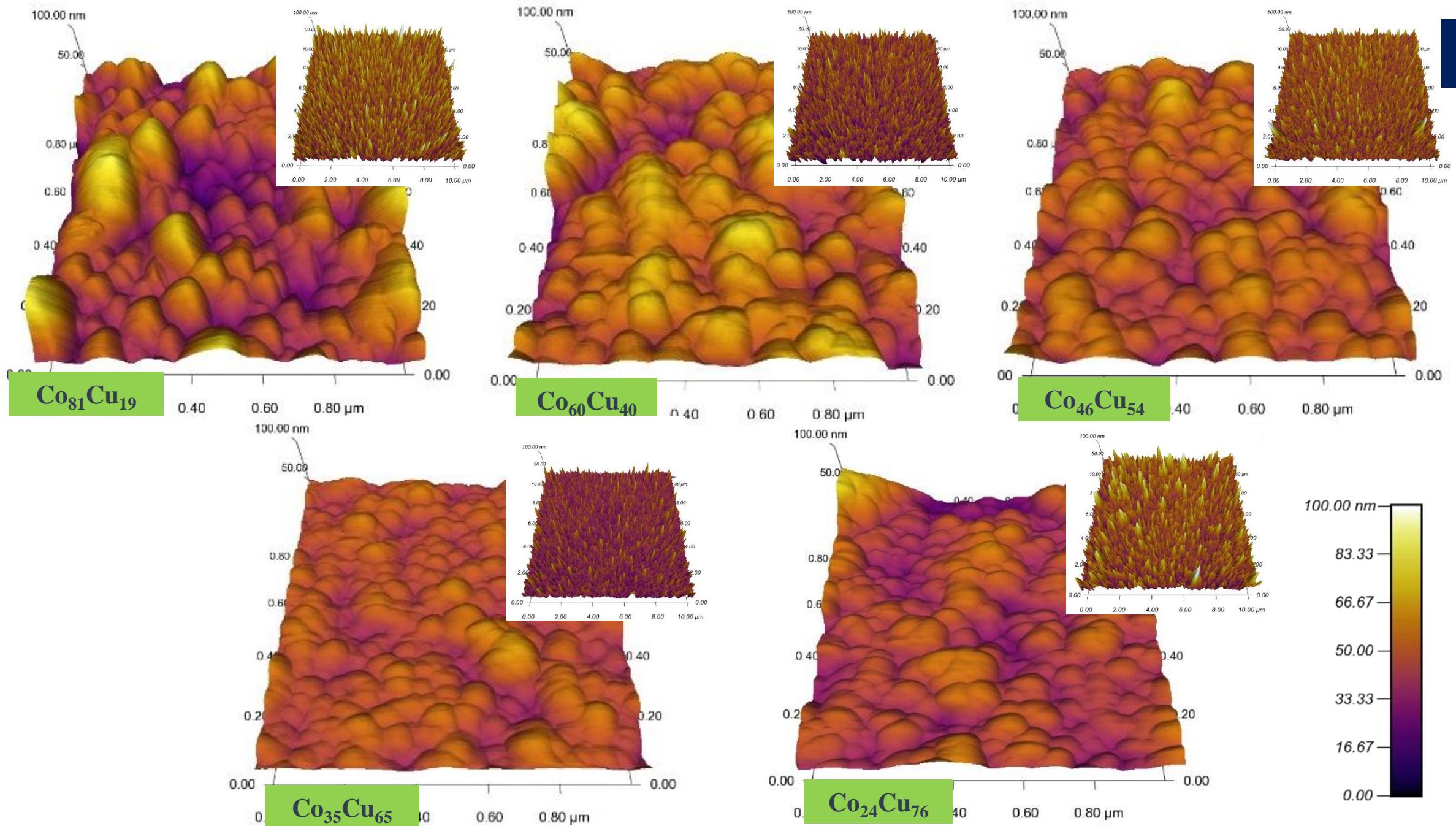
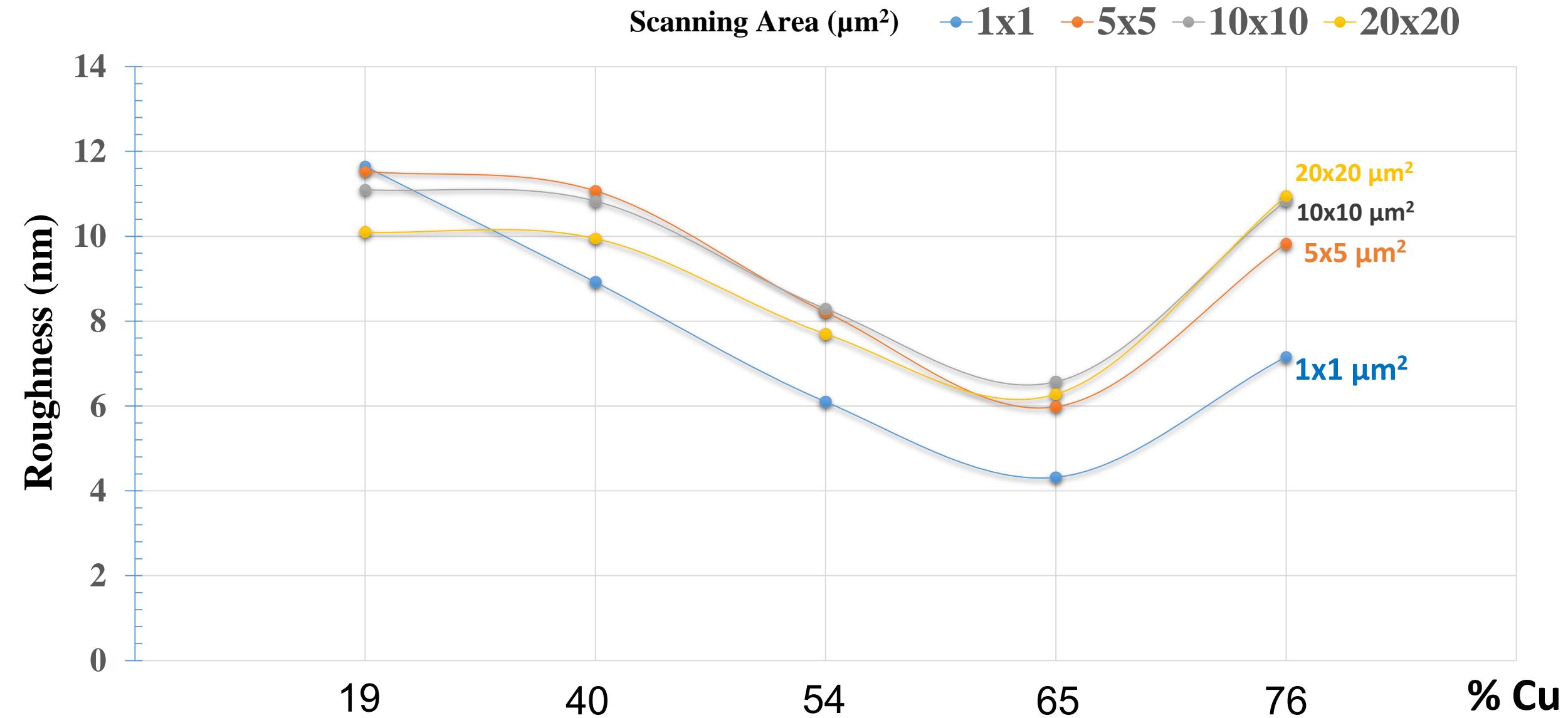


Fig. 3 Surface morphology of annealed Co-Cu thin films from AFM

Surface roughness of annealed Co-Cu thin films from AFM

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Perpendicular Magnetic Field

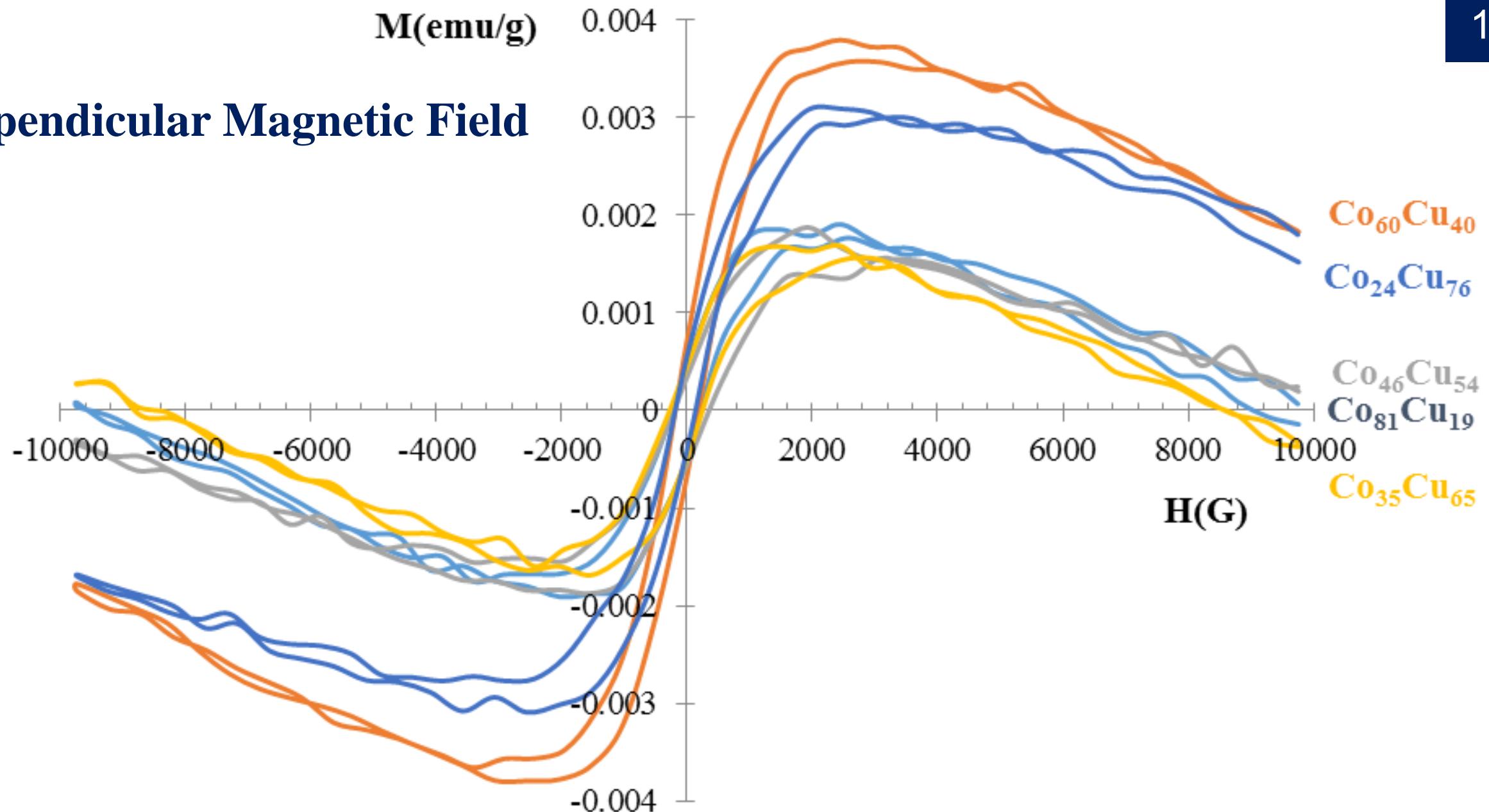


Fig. 4 Hysteresis loop of annealed Co-Cu thin films from VSM

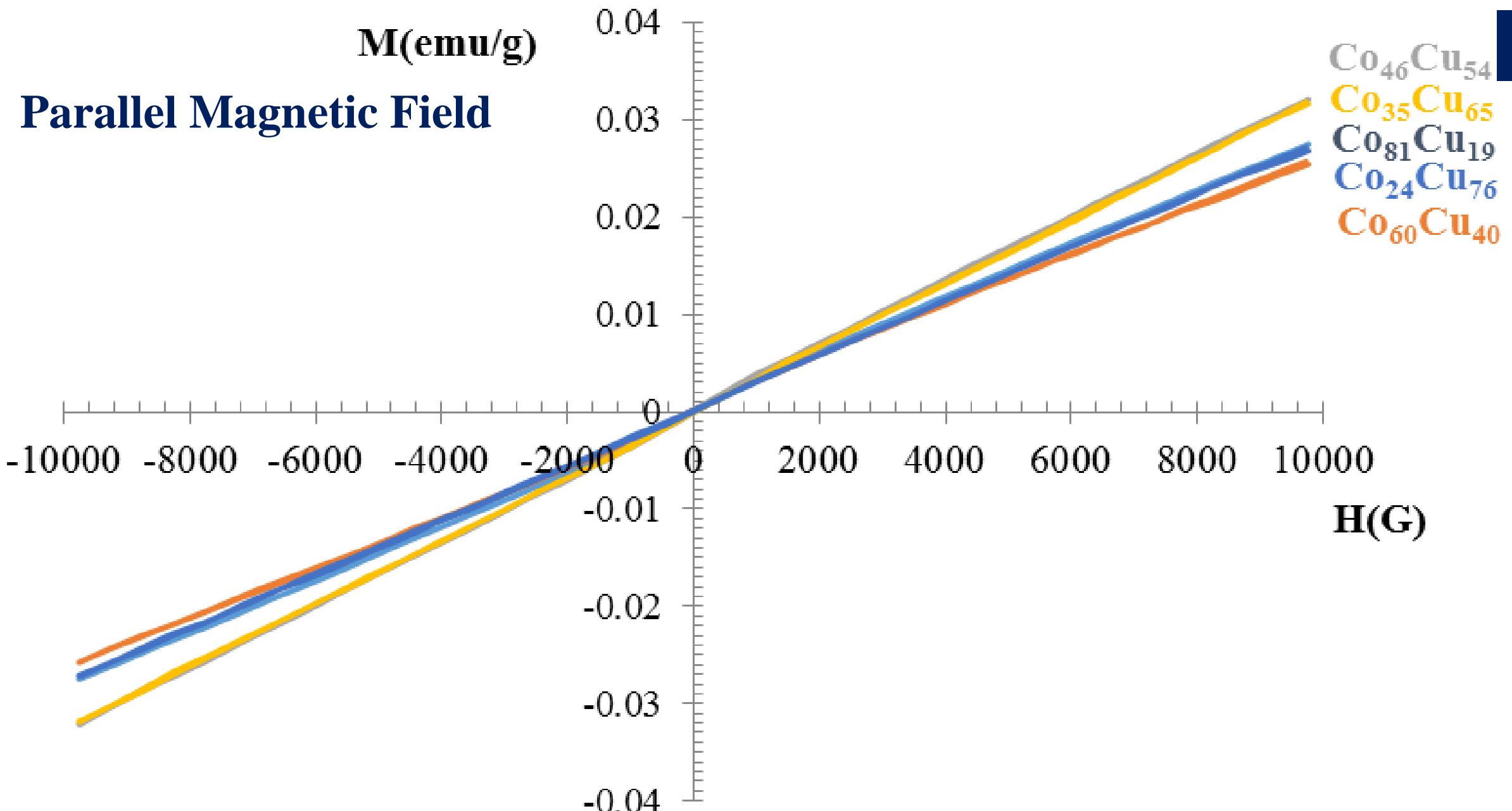


Fig. 5 Hysteresis loop of annealed Co-Cu thin films from VSM

Conclusions

- The annealed CoCu films showed Co(220), Cu(111) and oxide phases of CuCoO(222) Co_3O_4 in (222), (311) and CuO(-111).
- The surface roughness of annealed CoCu films is decreased with increasing Cu from 19 to 65 % but it is increased with increasing Cu 76%.
- The annealed CoCu films show ferromagnetic phase in perpendicular direction. Whereas films show paramagnetic phase in parallel direction.
- Heat treatment affects on properties by virtual of phase, distribution and surface.

THANK YOU FOR YOUR ATTENTION