



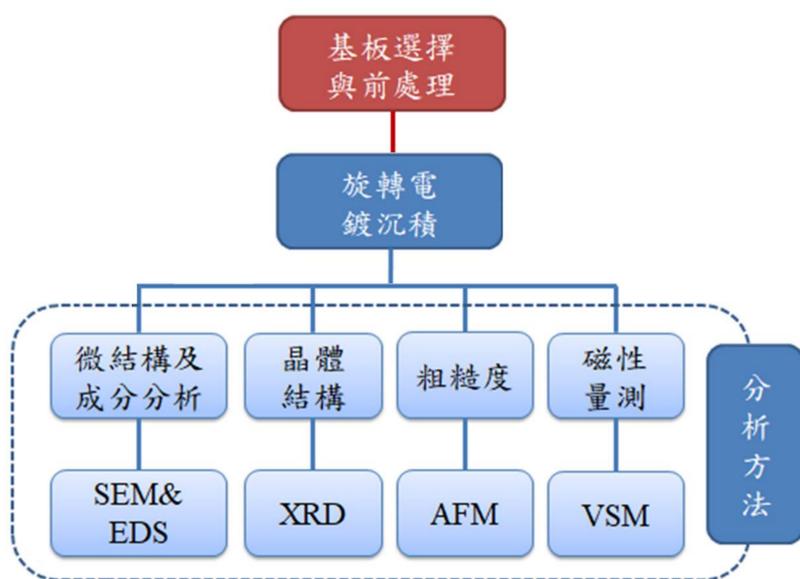
# Rotating-cathode electrodeposited Co-rich Co-Mn-P layers on Co-P modified surfaces as permanent magnet components

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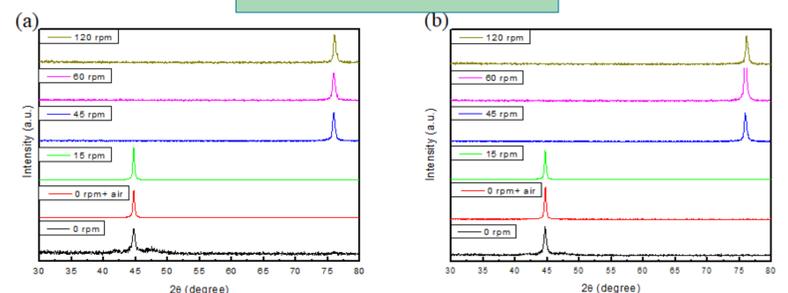
## Abstract

Thick layers of permanent magnetic cobalt-rich alloy are promising materials for the applications in microelectromechanical systems (MEMS). Rotating-cathode electrodeposition configuration, which was realized through a servomotor mounted on top of plating cell, for depositing thick Co-Mn-P permanent magnet layers on ring substrates has been demonstrated by our group. In this study, we adopted electroless depositing Co-P magnetic films as underlayers to modify the initial conditions of substrate surfaces for the subsequent rotating-cathode electrodeposition of Co-Mn-P thick layers. The effects of cathode rotational speeds and agitation methods on magnetic properties of electrodeposited Co-Mn-P layers on Co-P underlayers were studied. In this study, we paid special attention to the effect of Co-P underlayers on the resultant Co-Mn-P deposits.

## Experimental Procedures



## XRD

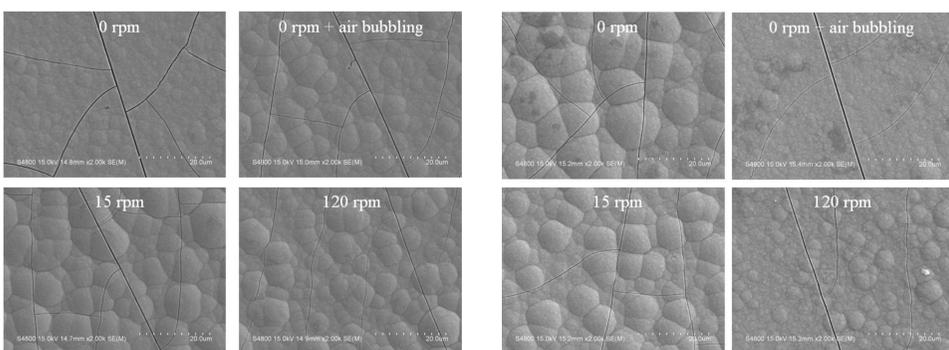


## EDS

Without $\text{CoCO}_3$	0 rpm	15 rpm	45 rpm	60 rpm	120 rpm	0 rpm + air
Co	93.54±2.97	94.66±3.00	94.60±3.25	94.29±2.99	94.55±2.96	94.73±3.05
Mn	1.47±0.11	0.83±0.07	0.54±0.10	0.61±0.08	0.47±0.07	0.78±0.08
P	5.00±0.25	4.51±0.22	4.86±0.28	5.10±0.26	4.39±0.24	4.50±0.22
With $\text{CoCO}_3$	0 rpm	15 rpm	45 rpm	60 rpm	120 rpm	0 rpm + air
Co	93.42±2.92	94.66±2.98	94.81±3.40	94.51±3.26	94.81±2.99	94.39±3.02
Mn	1.85±0.12	0.68±0.08	0.47±0.10	0.53±0.10	0.46±0.07	1.05±0.09
P	4.73±0.23	4.66±0.23	4.72±0.29	4.96±0.29	4.72±0.23	4.55±0.23

旋轉電鍍CoMnP EDS表

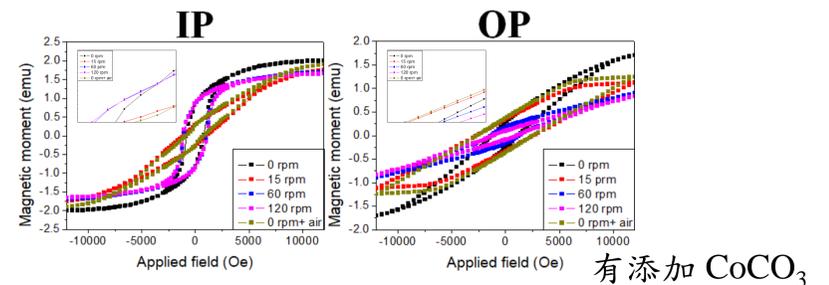
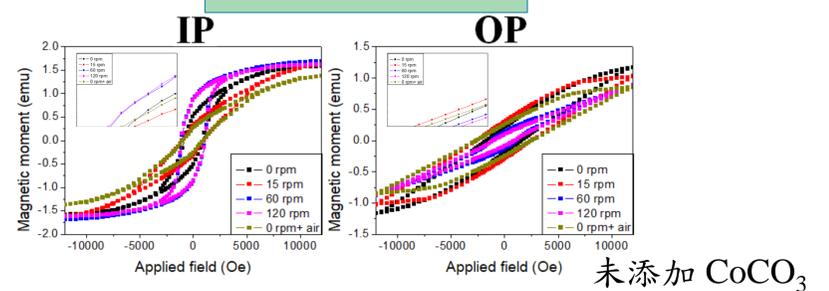
## SEM



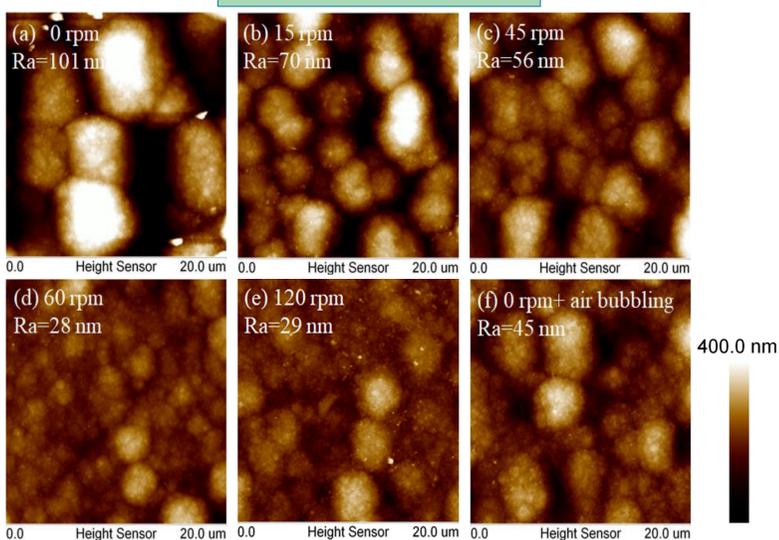
無添加  $\text{CoCO}_3$

有添加  $\text{CoCO}_3$

## VSM



## AFM



有添加  $\text{CoCO}_3$  之 CoP 底層，不同旋轉電鍍及攪拌參數

## Conclusions

- 陰極旋轉電鍍之轉速對磁性能有影響，在較低的轉速時，垂直磁性能較好
- 添加  $\text{CoCO}_3$  來無電鍍置入之 CoP 底層，並不會影響到後續在其上方進行旋轉電鍍 CoMnP 膜層之磁性能
- 提高些許轉速時仍能具有較好之垂直方向磁性能，同時能使膜層的均勻性持續維持