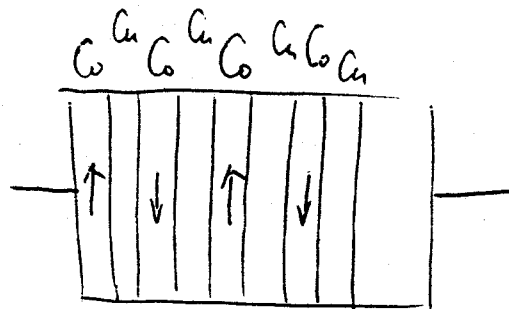
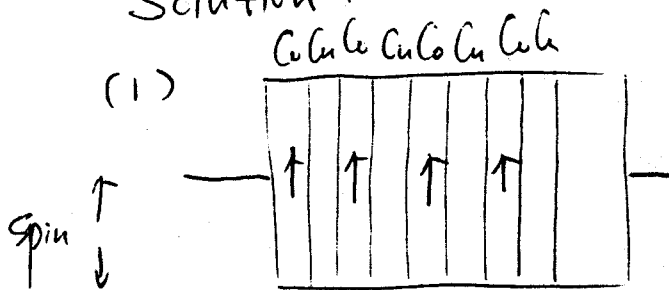
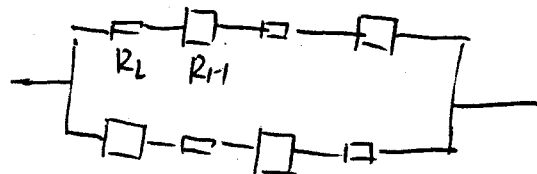
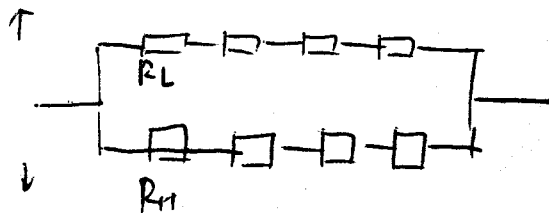


Solution



Spin direction is same as  $C_o$  moment,  $R_L$   
 Spin direction is opposite to  $C_o$  moment,  $R_H$   
 Parallel Anti-parallel



$$R_p = 4R_L // 4R_H$$

$$= \frac{4R_H R_L}{R_H + R_L}$$

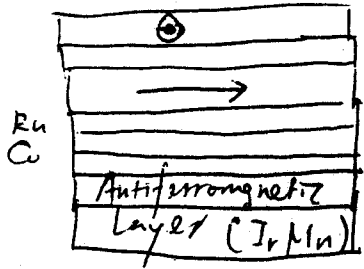
$$R_{AP} = 2(R_H + R_L) // 2(R_H + R_L)$$

$$= R_H + R_L$$

$$R_{AP} - R_A = \frac{R_H^2 + R_L^2 - 2R_H R_L}{R_H + R_L} = \frac{(R_H - R_L)^2}{R_H + R_L} > 0$$

Solution

(2)



Co  
 Co  
 Co

Pinning Layer

⊙ or ⊗ magnetization

Two reasons: ( $> T_N$ )

- ① align the atoms of AFM layer
- ② align the grains of ferromagnetic layer

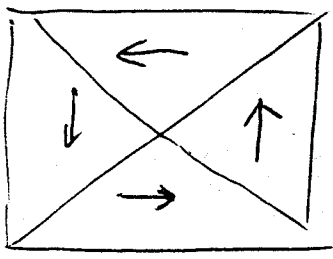
Cubic symmetry

(3)

V fcc phase, magnetic soft  
 hcp phase, magnetic hard, uniaxial  
 free layer of sensor needs magneticall soft.

(4)

Not uniform.



500 nm

(5)

$$\frac{k_u V}{k_B T} = 40$$

$$V = 20 \times 10 \times 2 \times (10^{-7})^3 \text{ cm}^3$$

$$T = 300 \text{ K}$$

$$k_B = 1.38 \times 10^{-16} \text{ erg/K}$$

$$k_u = \frac{40 k_B T}{V} = \frac{40 \times 1.38 \times 10^{-16} \times 300}{4 \times 10^{-19}} = 1.38 \times 10^6 \text{ (erg/cm}^3)$$