Nano-Injection Molding Technology for Ultra-High-Density Patterned Magnetic Media

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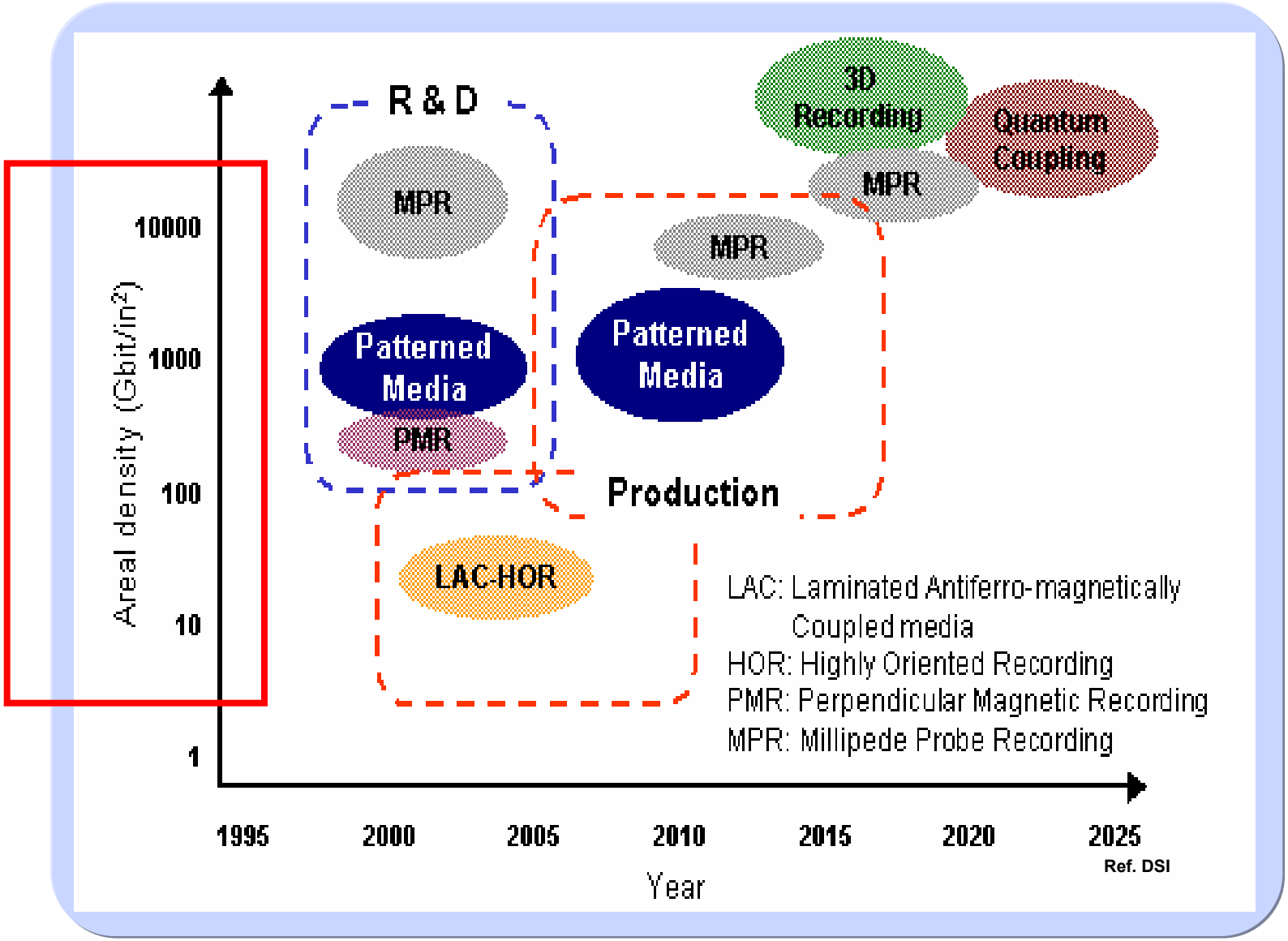
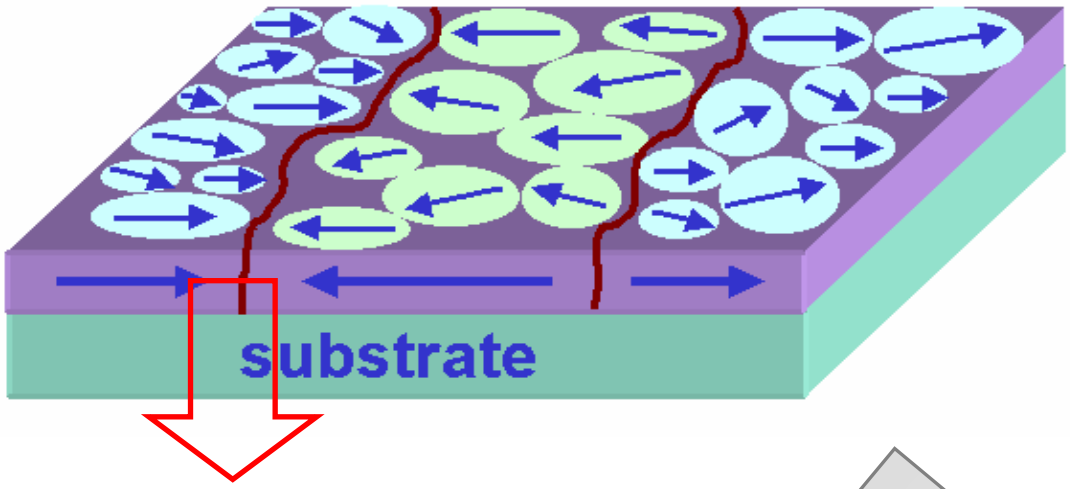
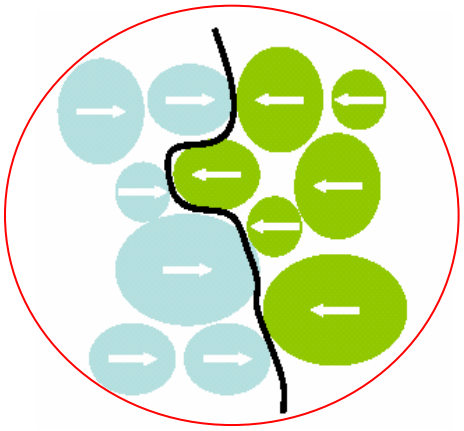
Demand for Ultra-High-Density Magnetic Media



Motivation for Patterned Media

Conventional Continuous Media

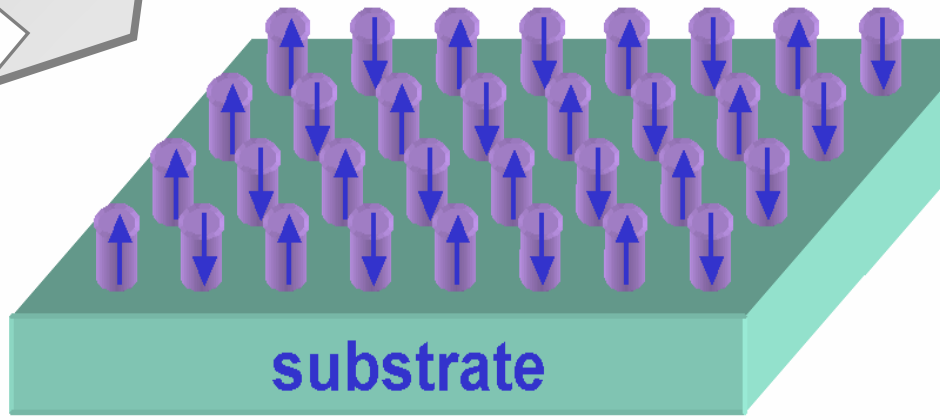




Zigzag Jitter @ Transition

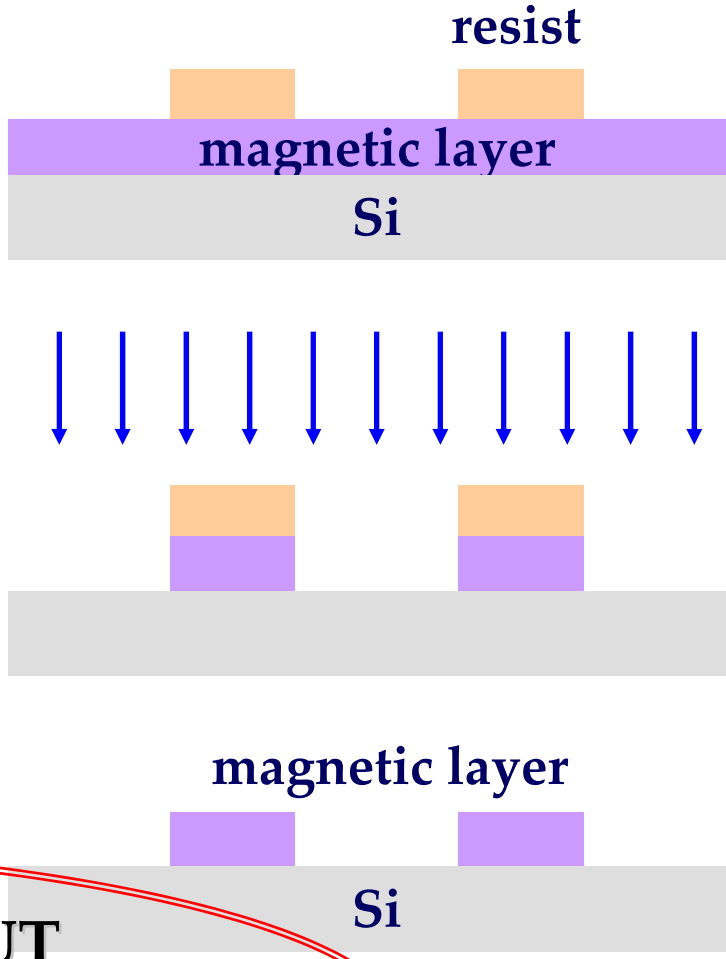
- Barriers to Overcome
  - Medium Noise
  - Demag. Field
  - No Sharp Transition

Patterned Media



Various Technologies for Patterned Media

- Direct Patterning
  - A. E-beam Lithography
  - B. Defining Magnetic Islands by
    1. Focused Ion Beam (FIB)
    2. Reactive Ion Etching (RIE)
    3. Ion-Beam Milling
- Nano-Imprinting Technology



Those technologies are fine BUT

Not appropriate for mass-production

due to low throughput, low yield and high cost!

Processes for Nano-Injection Molding Technology

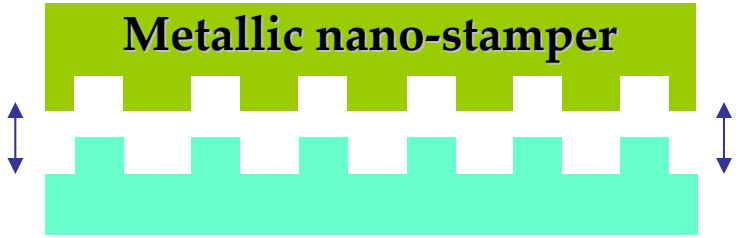
(a) E-beam patterning

(b) ICP etching

(c) Si nano-master

(d) Fabrication of polymeric nano-master by UV molding

(e) Fabrication of metallic nano-stamper by electroforming



(f) Nano-injection molding

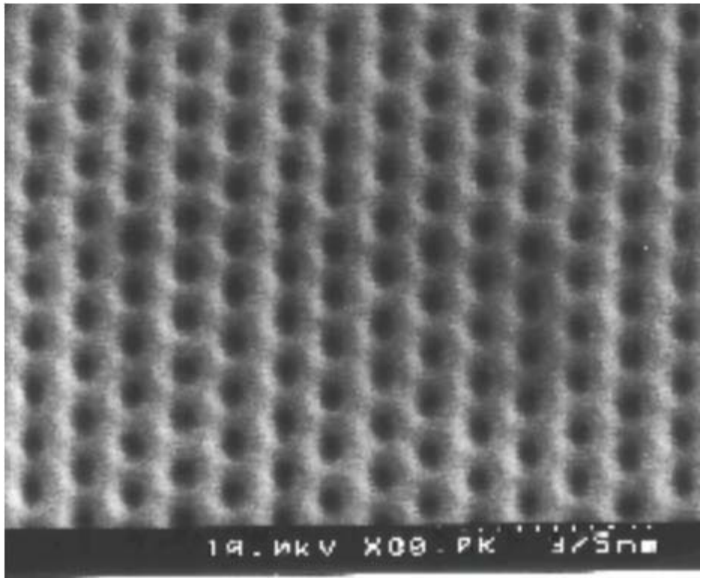
(g) Polymeric pillar patterns

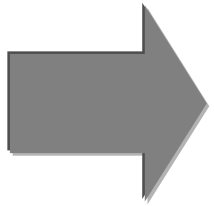
(h) Deposition of magnetic materials

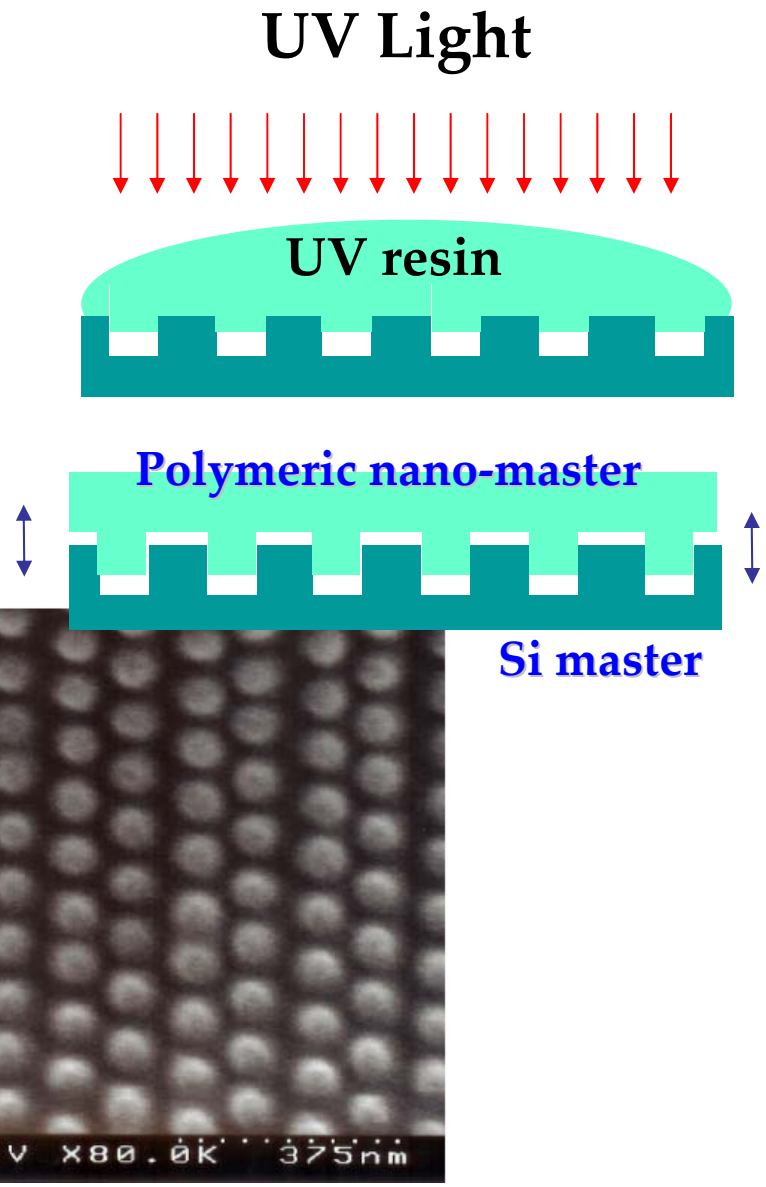
Fabrication of Polymeric Nano-Master

- Si Master

(CD: 40nm, pitch: 80 nm)

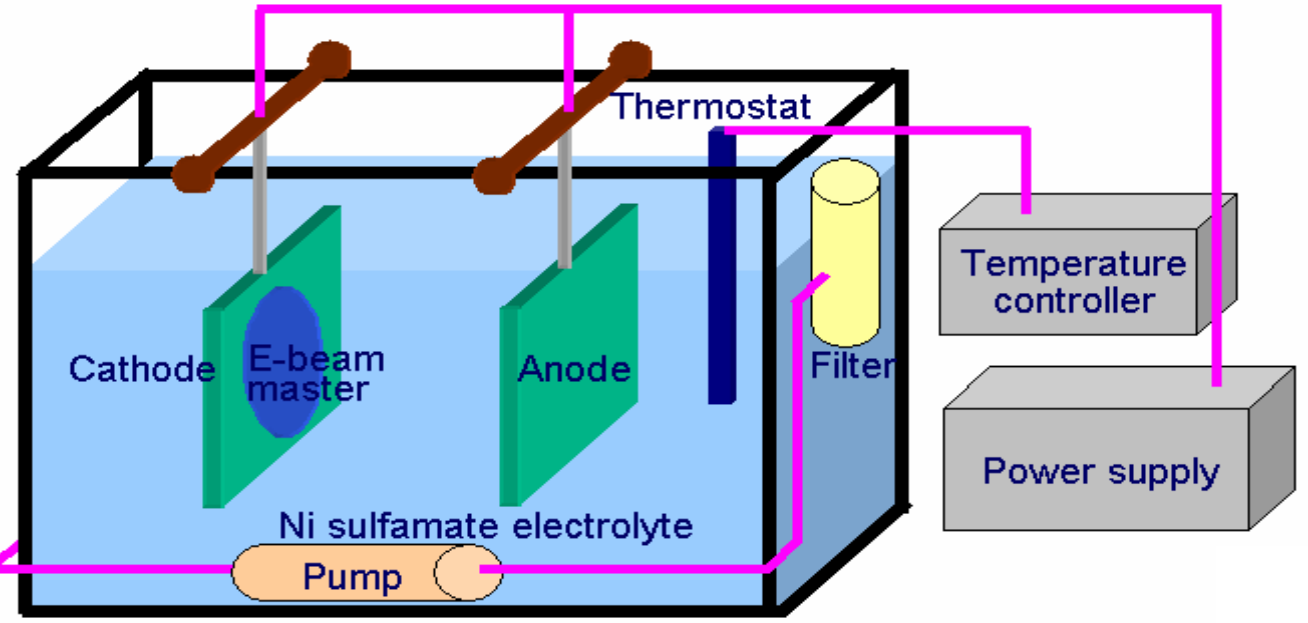






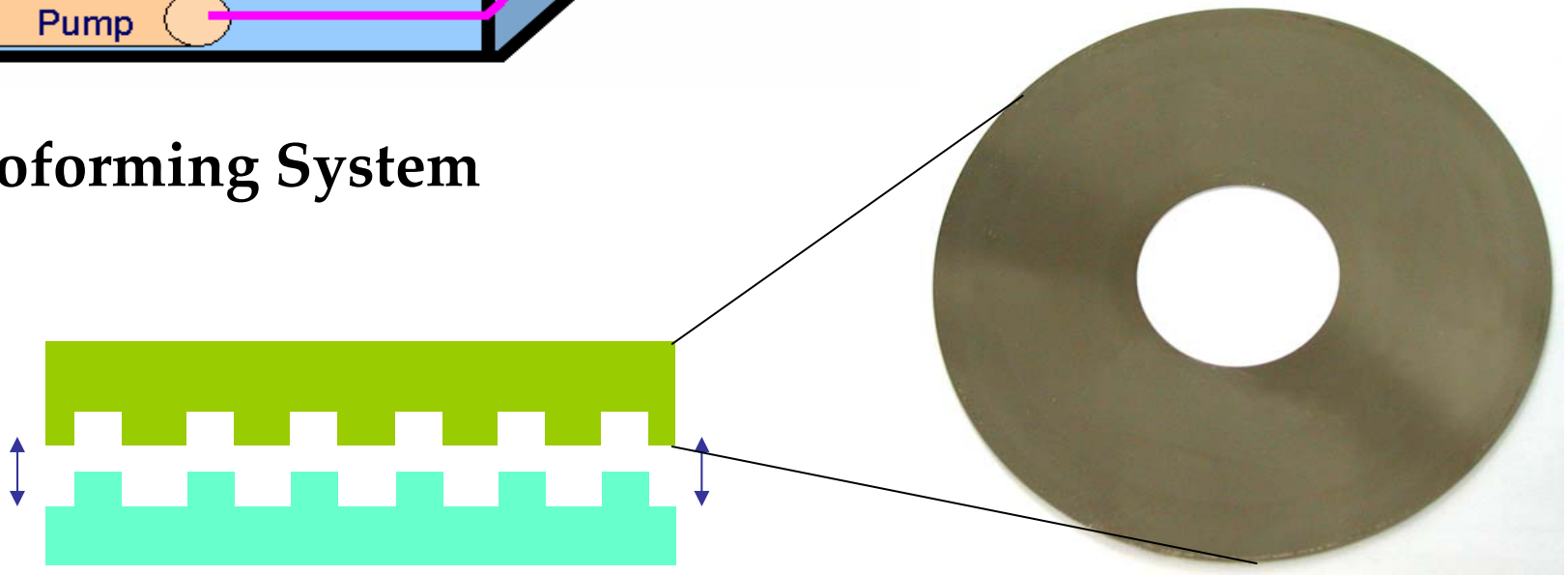
- Polymeric Nano-Master by UV Molding

Fabrication of Metallic Nano-Stamper

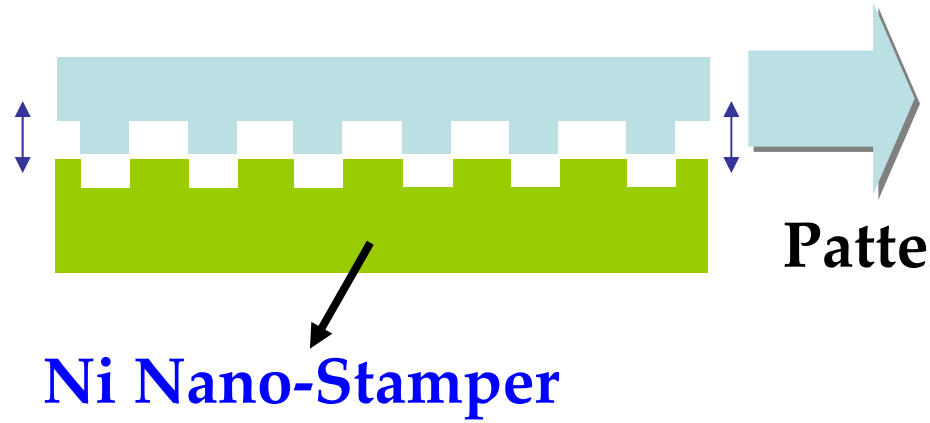


Metallic Nano-Stamper

- **Electroforming System**

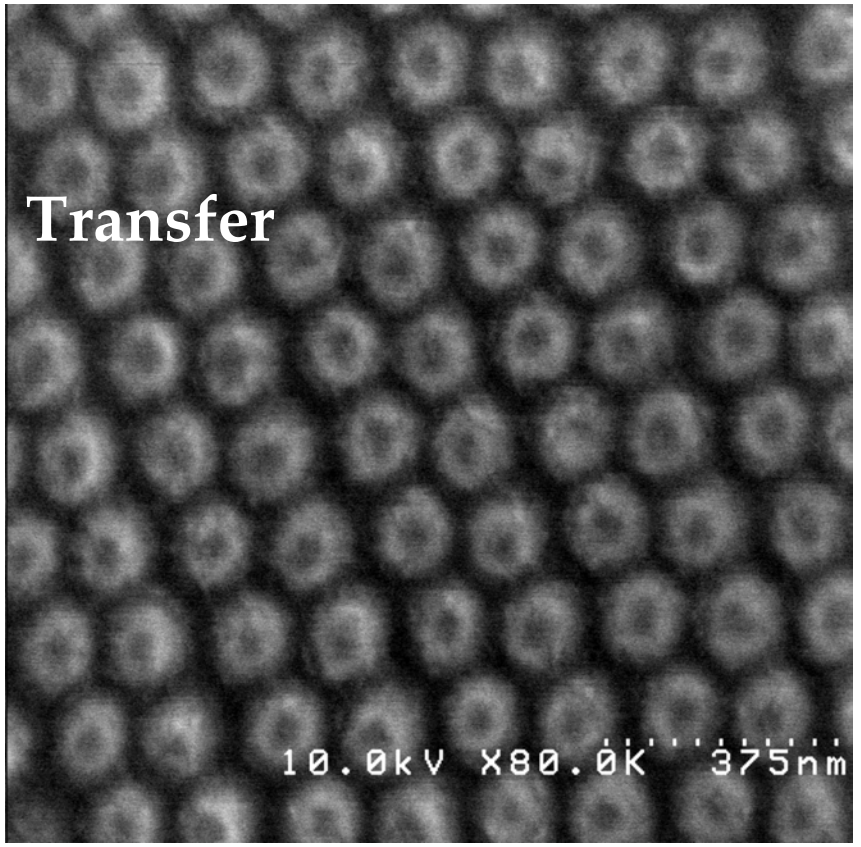


Nano-Injection Molding Technology



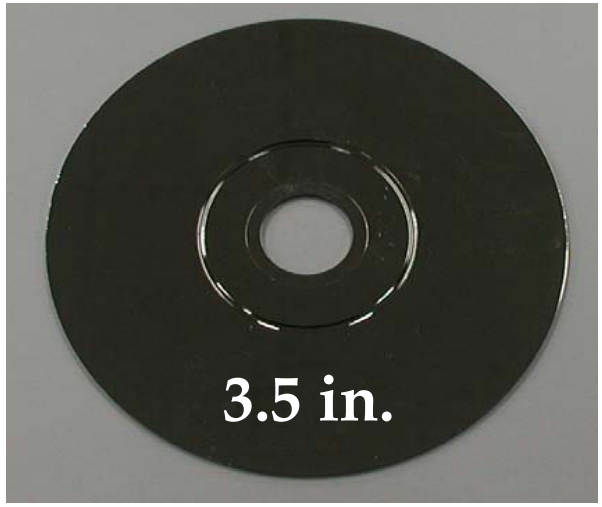
Pattern Transfer

Ni Nano-Stamper

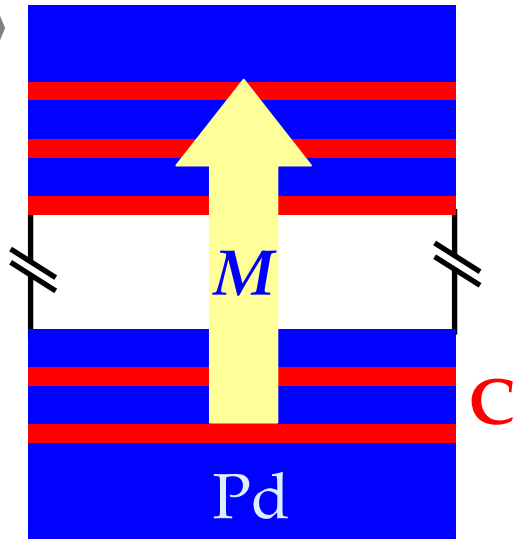


Polymeric Patterns
(CD: 40 nm, pitch 80 nm)

Deposition of Magnetic Materials

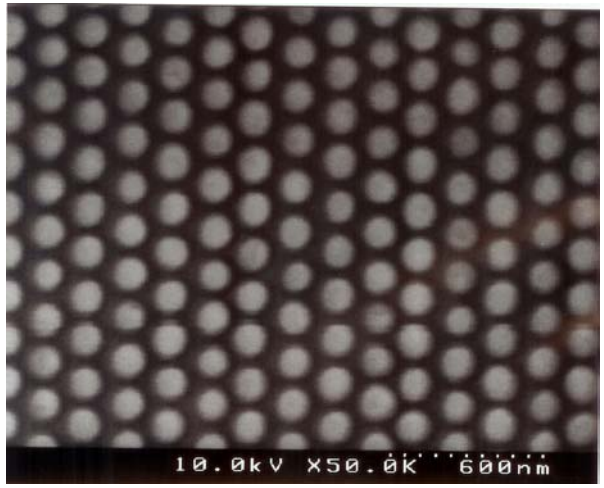


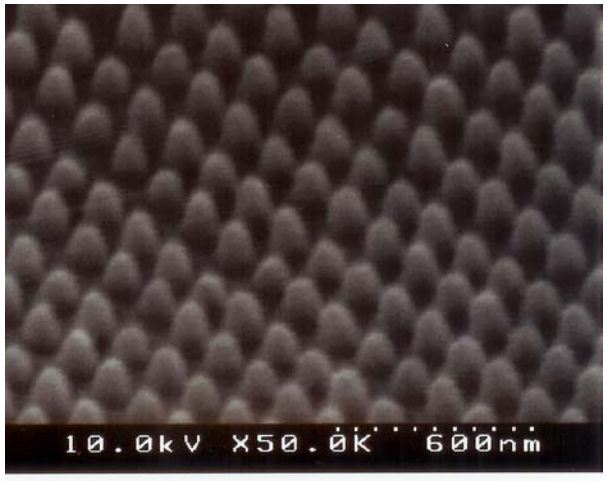
Magnetic Islands on 3.5 inch Media (CD: 40 nm, pitch 80 nm)



$[Pd/Co]_{10}$

Perpendicular Magnetic Media



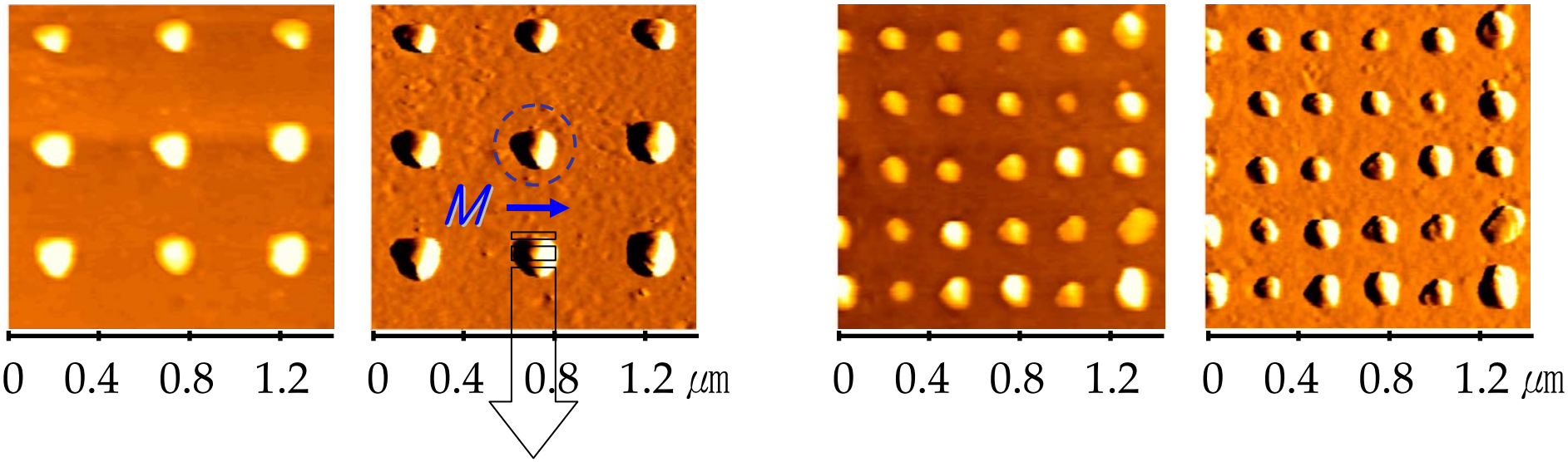


Previous Studies and Acknowledgment

Nanotechnology, 15 (8), 901-906, 2004

(1) CD: 200 nm, pitch 500 nm

(2) CD: 100 nm, pitch 250 nm



Single magnetic domain state

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