Magnetic force microscopy of bit erasure in magnetic recording media

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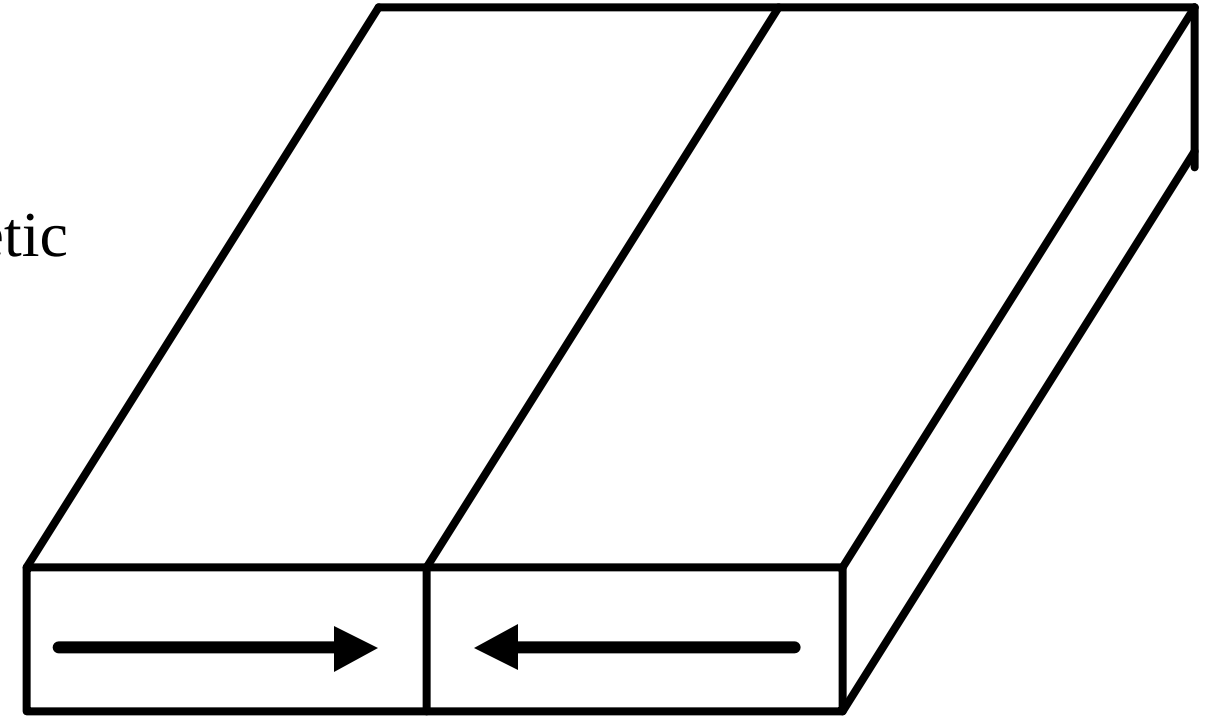
H External Field

- Transition not step functions.
- We want to study interface as f(H).

Magnetic Bit



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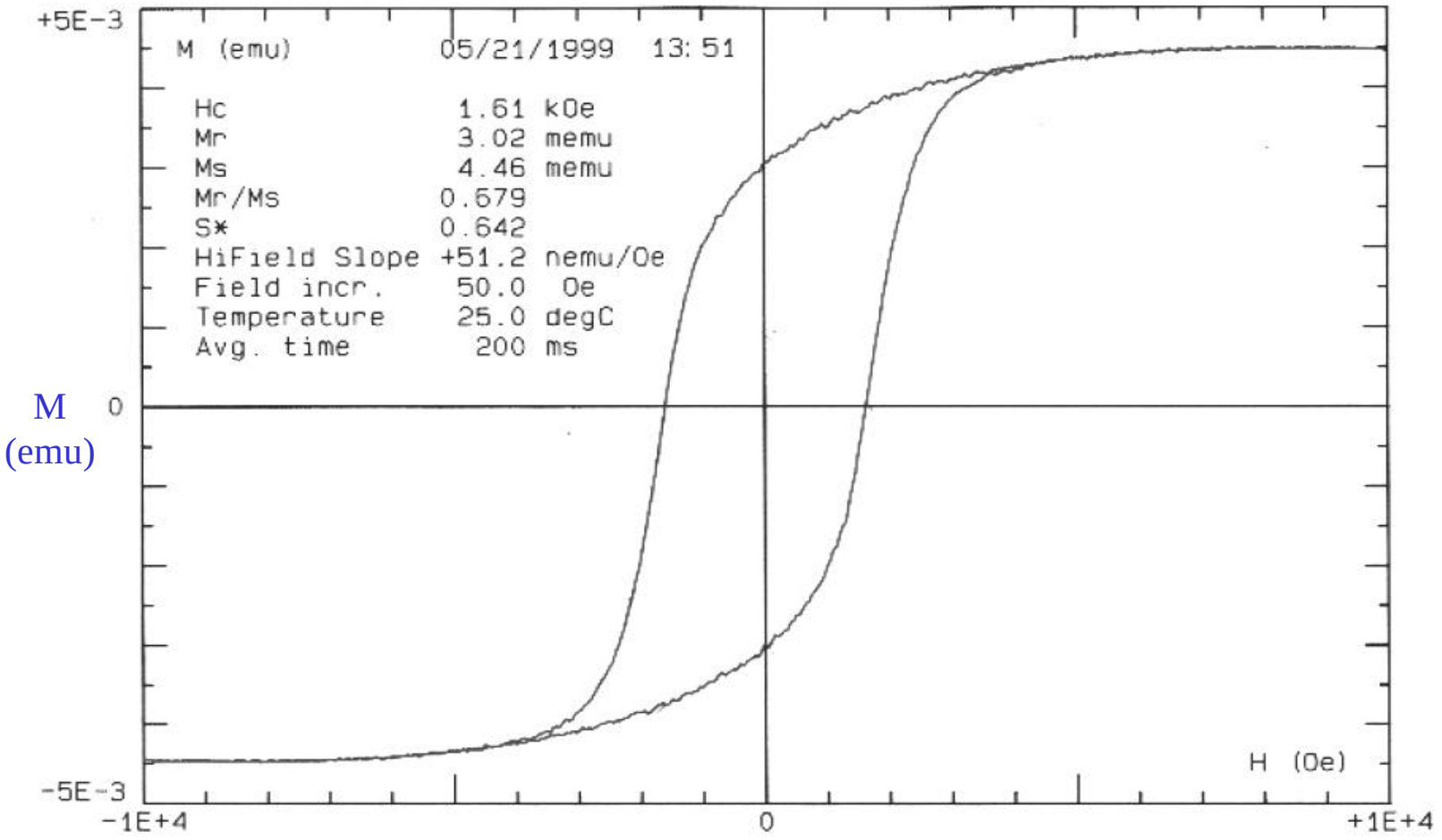
Hysteresis Loop (Bulk)



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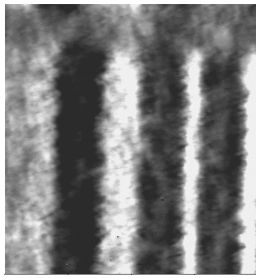
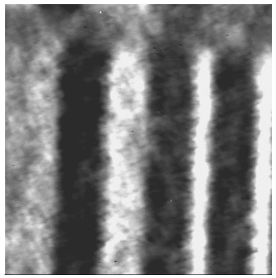
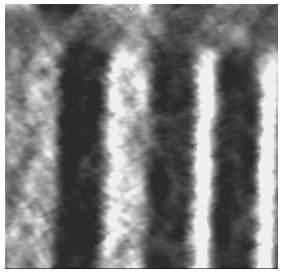
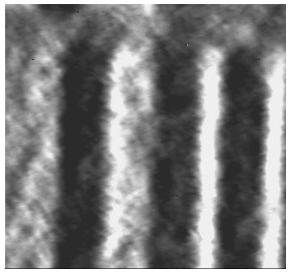
H

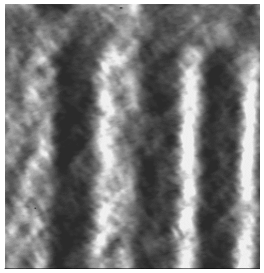
10 μm x 10 μm

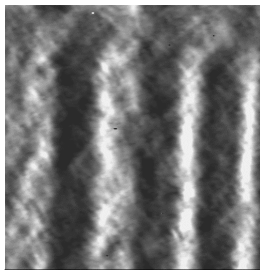

375 Oe

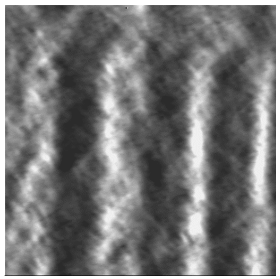

730 Oe

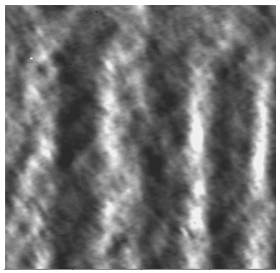

970 Oe

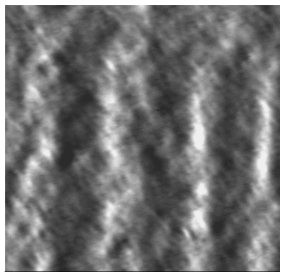

1210 Oe

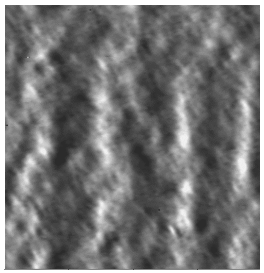

1440 Oe

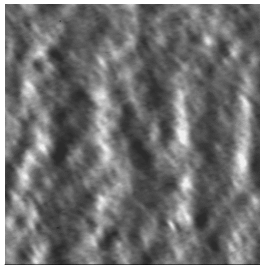

1560 Oe

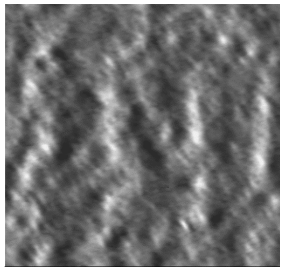

1680 Oe

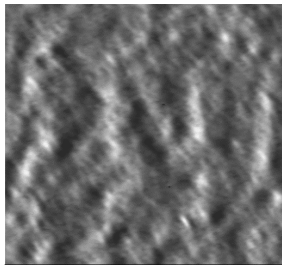

1800 Oe

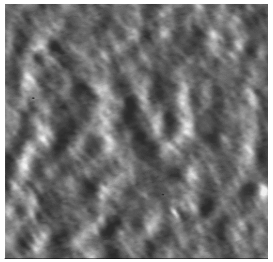

1920 Oe

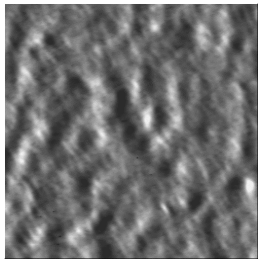

2040 Oe


2160 Oe


2280 Oe


2400 Oe


2640 Oe


3100 Oe

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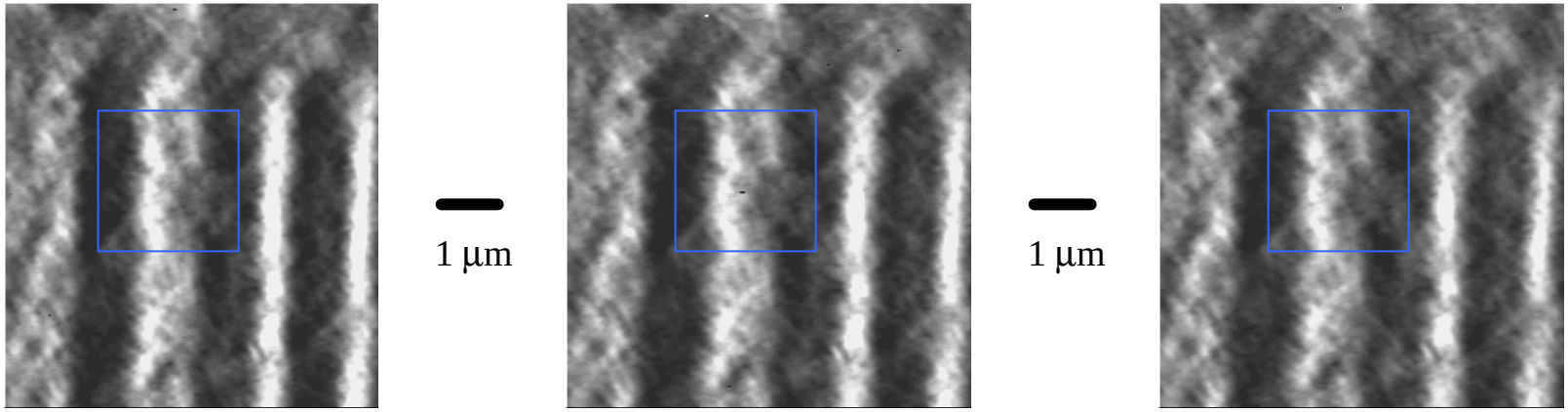

1440 Oe 1560 Oe 1680 Oe

- Large scale penetration of bit erasure into previously established domains
- Large scale degeneration of data bits
- No clearly identifiable data bits wider than 1 μm (length of black bar located in between the images) on a side are visible

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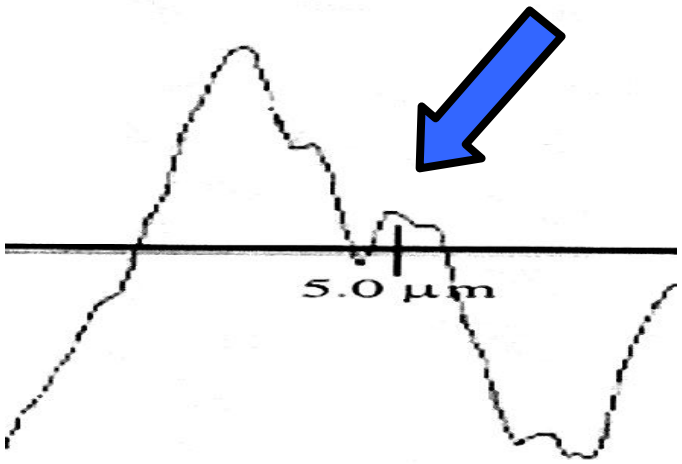
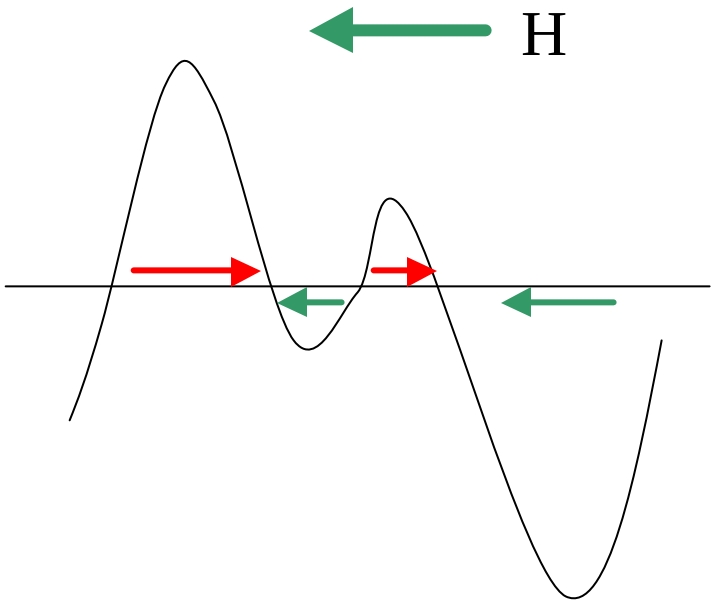
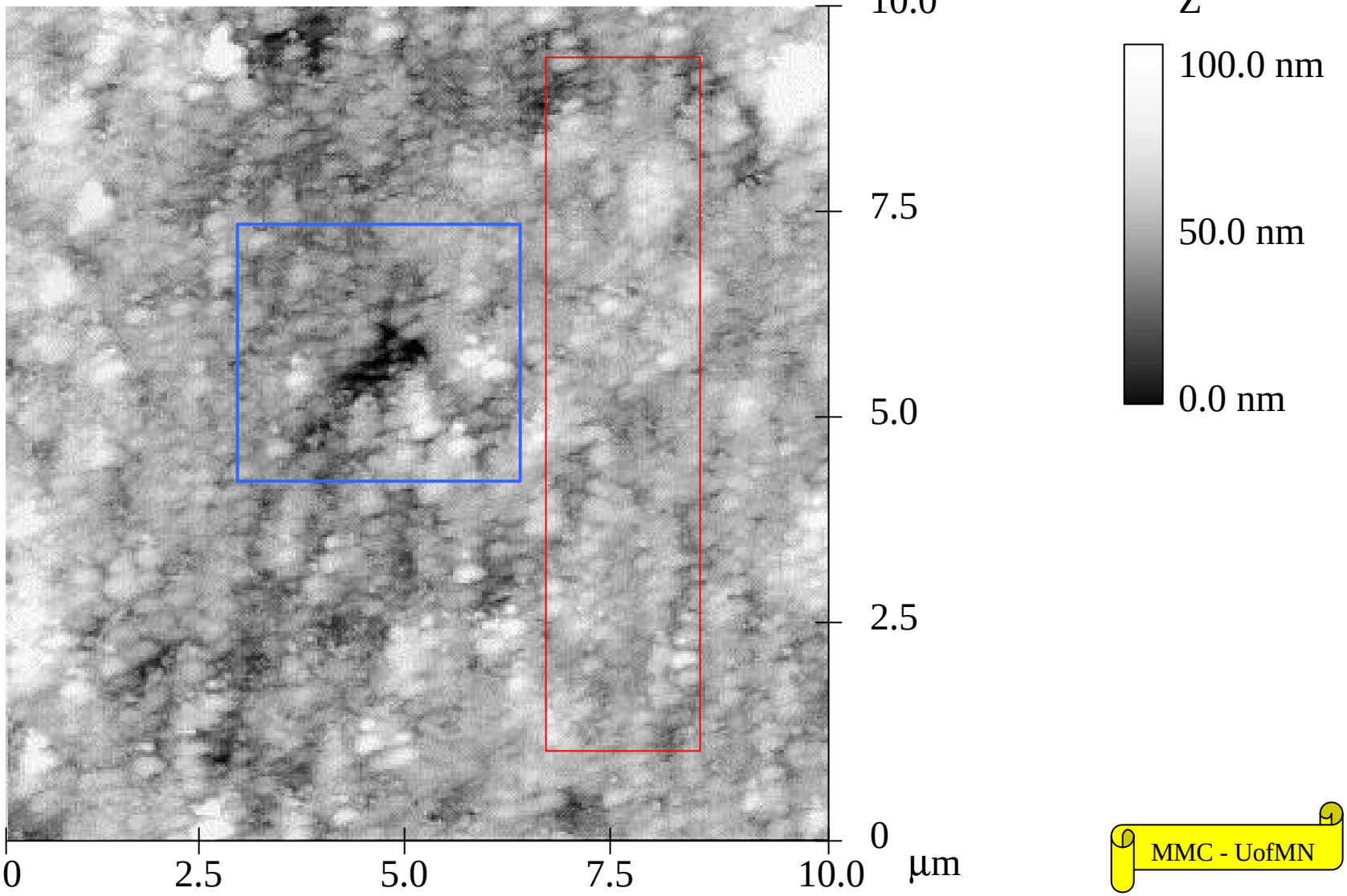


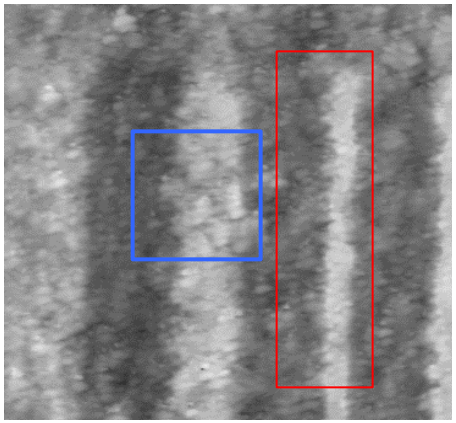


- Closer examination suggests that the degeneration occur near the regions where magnetic domains were initially irregular
- The likelihood of bit degeneration rests largely on whether it is energetically favorable for the bits to align with the externally applied field

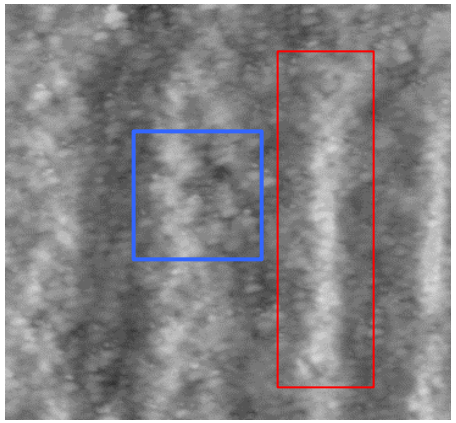
Topography



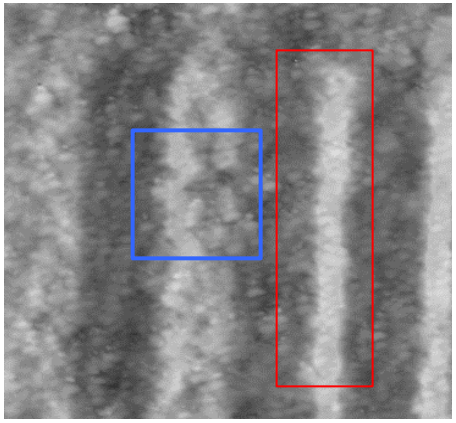
Magnetic-Topography Overlay



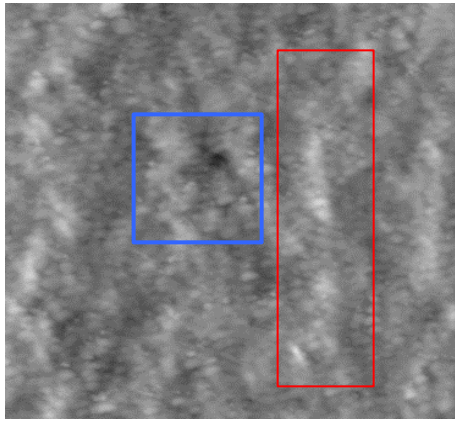
375 Oe



1680 Oe



1210 Oe



2400 Oe

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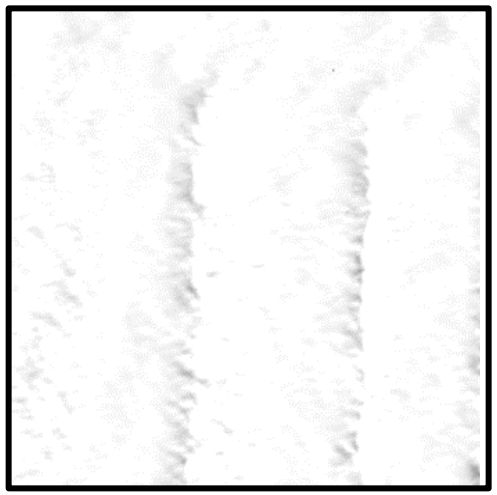
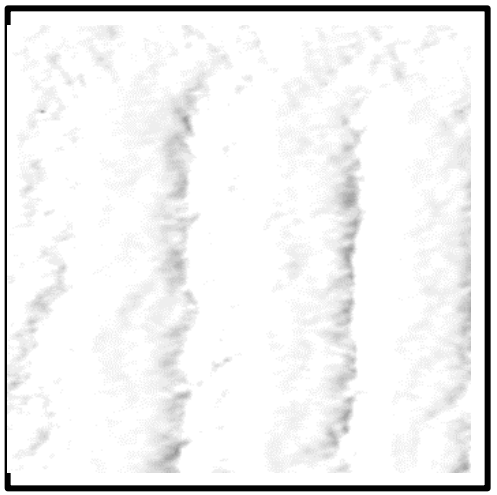
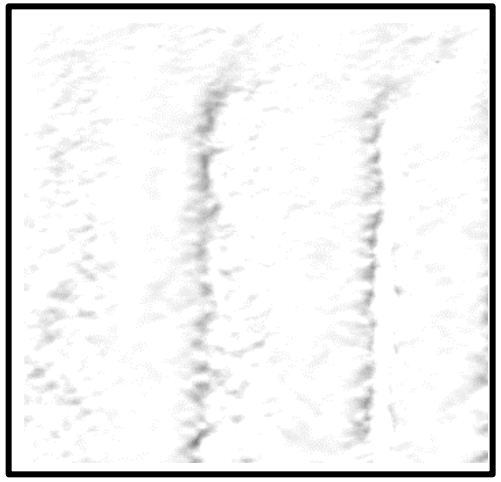
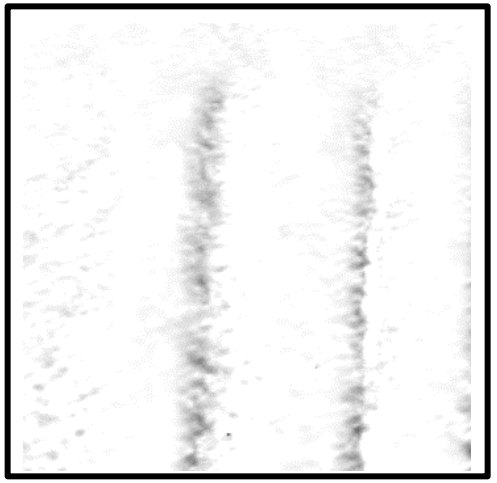
Subtraction of subsequent images









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Summary

- Bit erasure in magnetic recording media has been studied using MFM with increasing external magnetic fields
  - Susceptible to alignment at an applied field of **~1.4 kOe**
    - Once the initial erasure began it became more favorable for the neighboring regions to align
    - Continued increase in the externally applied field yielded expansions in the bit degeneration, protruding into the previously established data bits
    - Initial bit alignment due to unstable domain walls created by the high and low regions present in the recording media