Reversible Optical Recording on Epitaxial Indium Selenide Phase-Change Media

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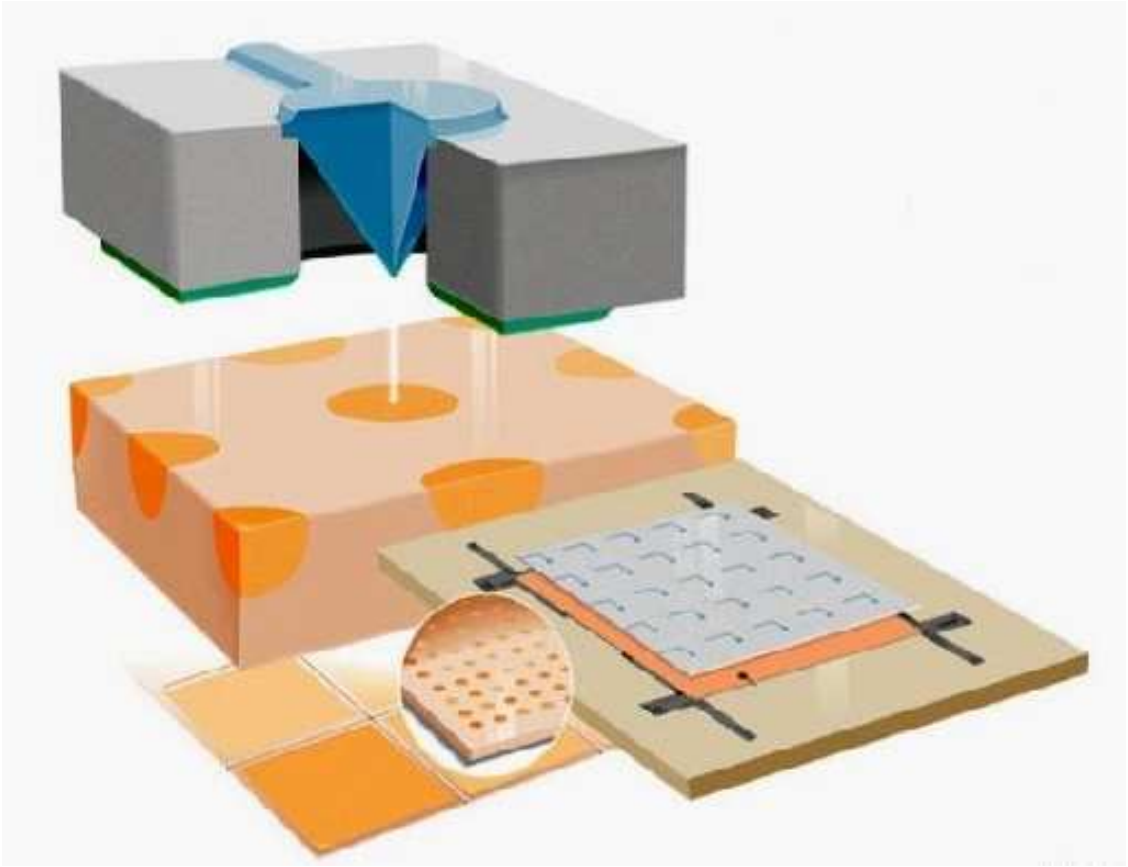
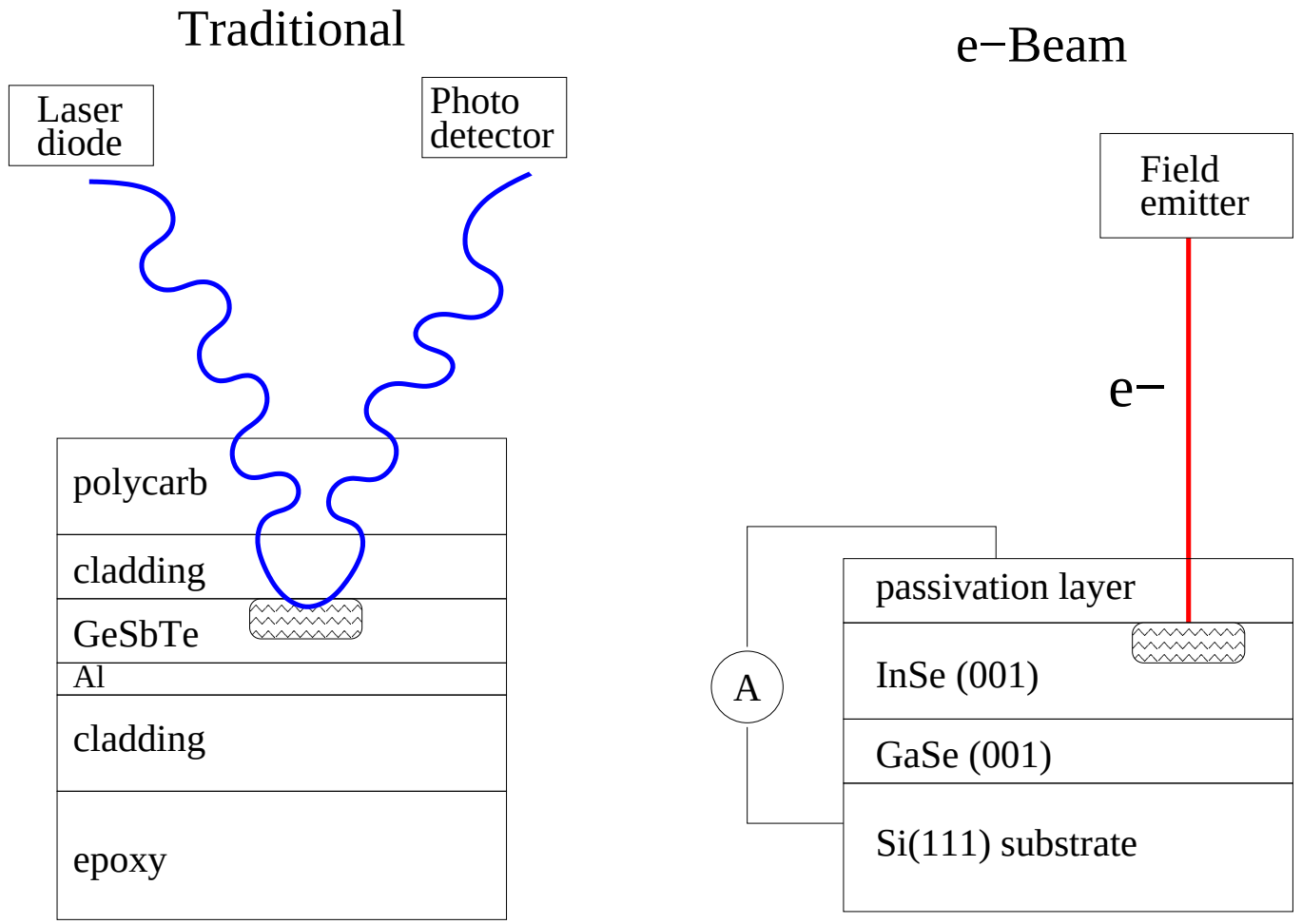
Electron-Beam Recording on Phase-Change Media



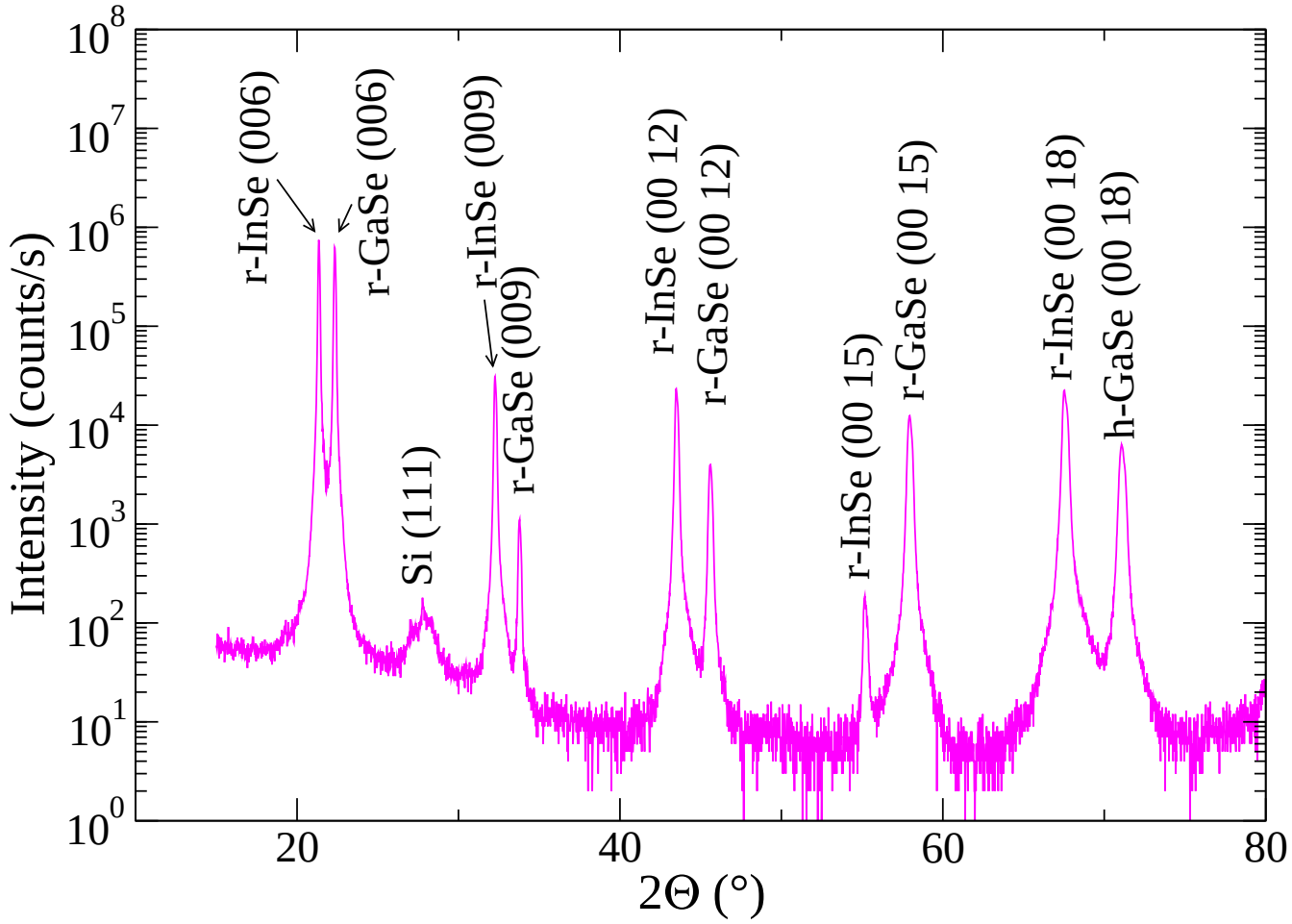
From **Scientific American**, March 2000.

See also S.-T. Lam, J. Vac. Sci. Techn. **21**, 479 (2003).

Optical vs. Electron-Beam Recording

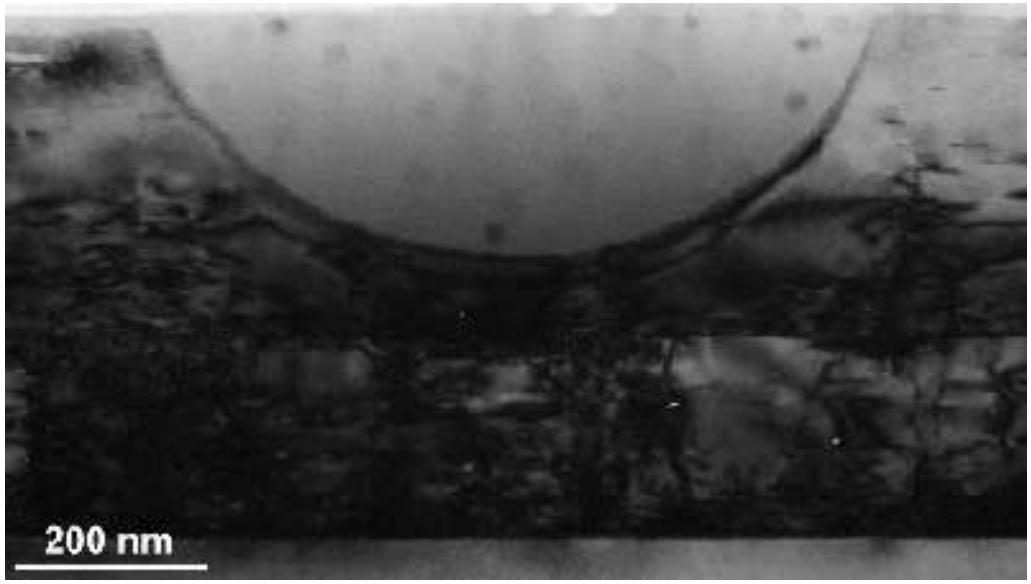


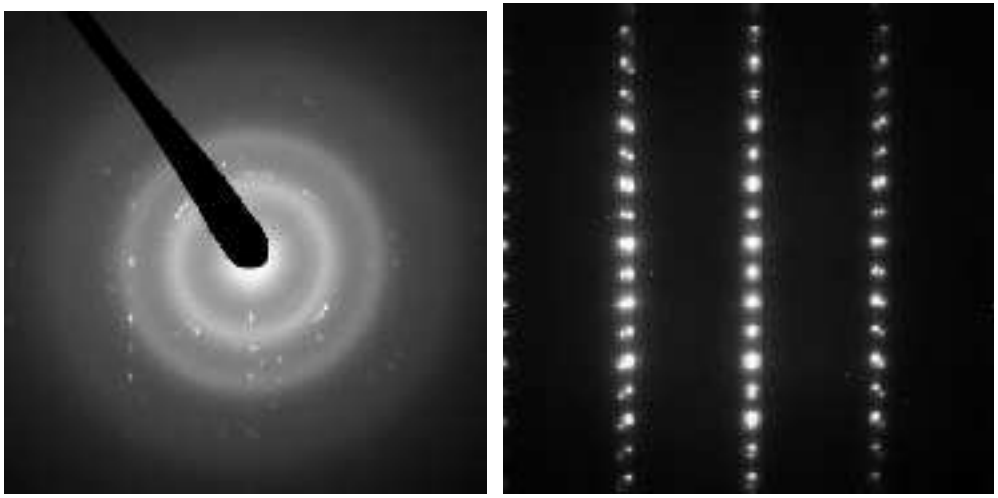
Good Quality Epitaxial InSe/GaSe/Si(111) Films



Phase-change materials with decent semiconducting properties that grow well on Si!

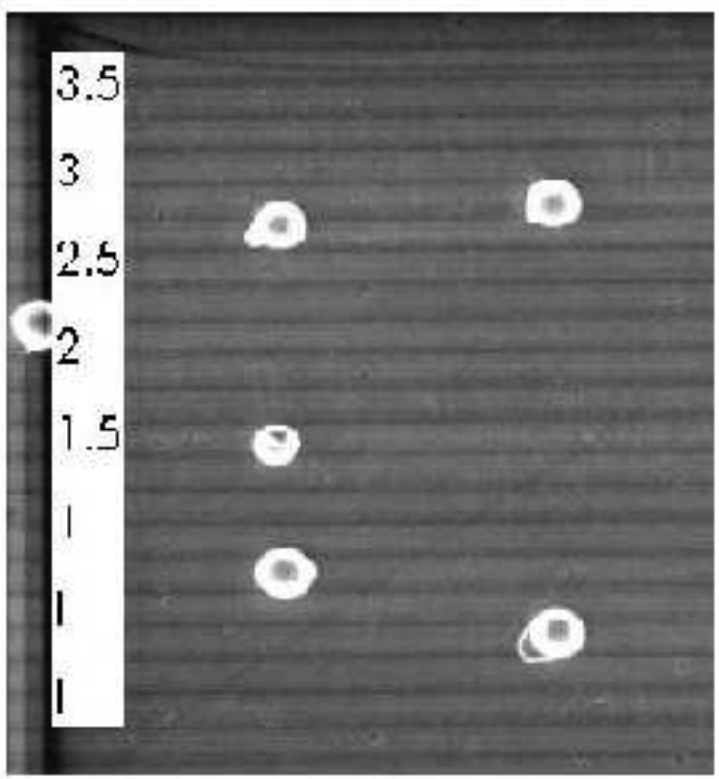
Amorphous Laser Marks

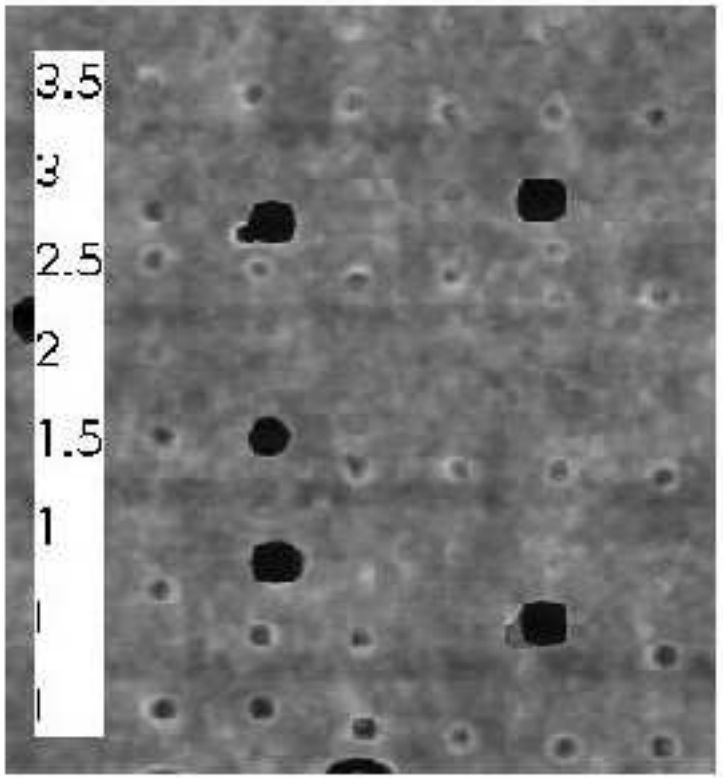




Laser used to simulate e-beam recording.

Electronic Contrast and Erasure Observed without Surface Damage



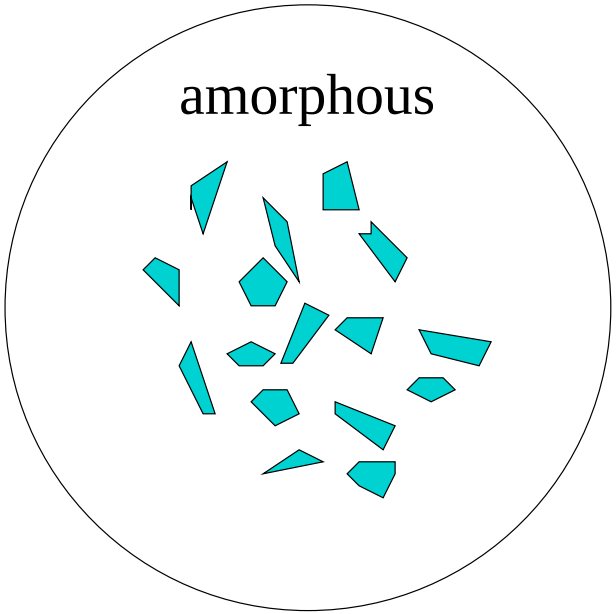


I = Write pulse; 1 = Write/Erase; 1.5 = WEW ...

Up to 100 cycles with only minor degradation.

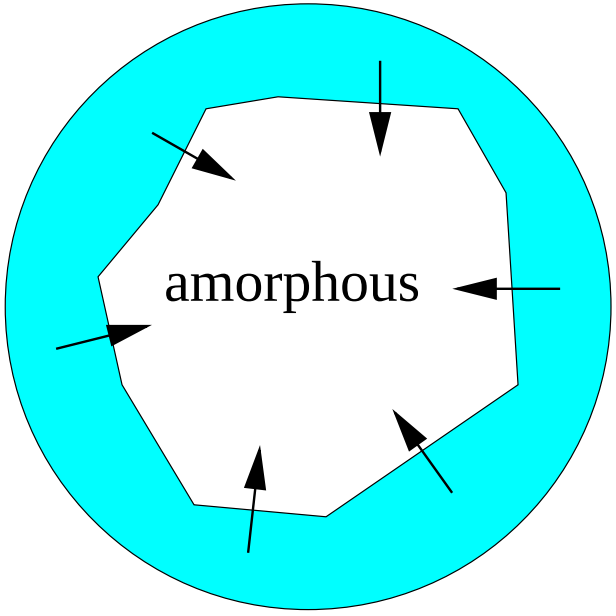
Scaling of Erasure Time Depends on Recrystallization Mode

Homogeneous nucleation plus growth



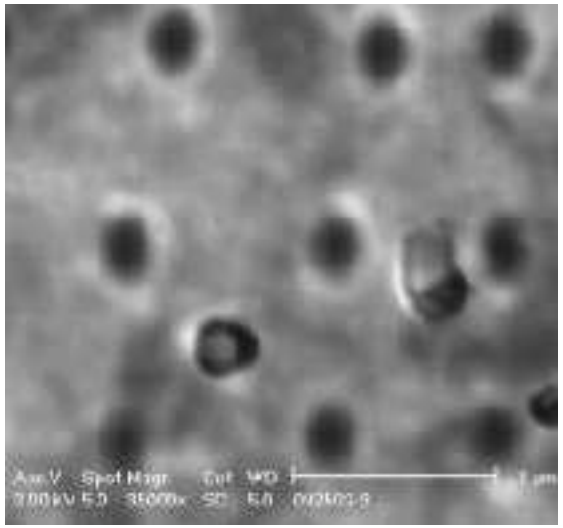
Like GeSbTe

Regrowth from crystalline matrix without nucleation

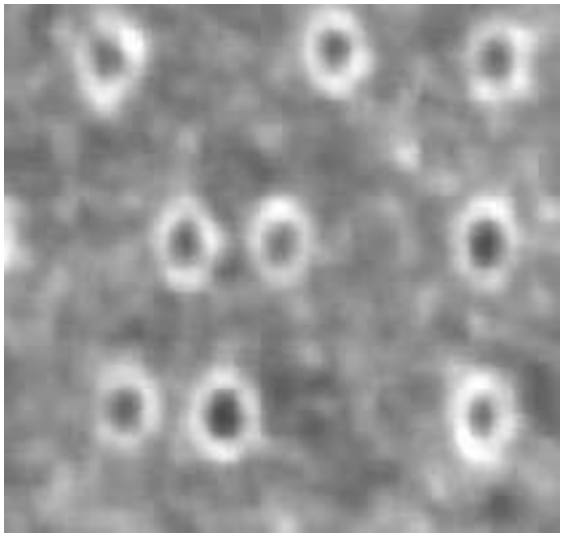


Like InAgSbTe

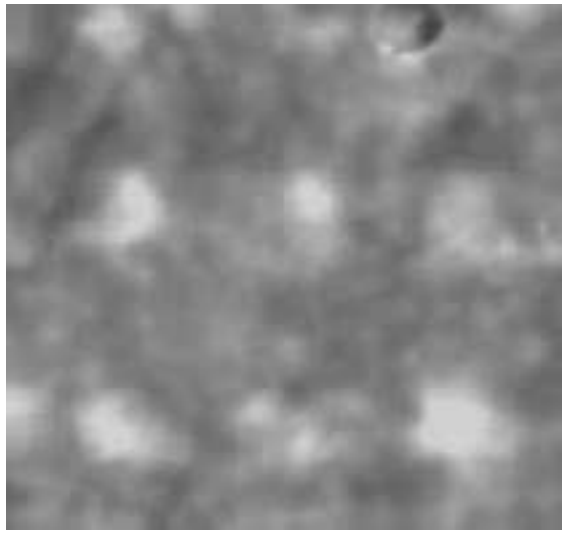
Some Evidence for Regrowth from the Matrix



Write pulse only



Write + 10 μS erase

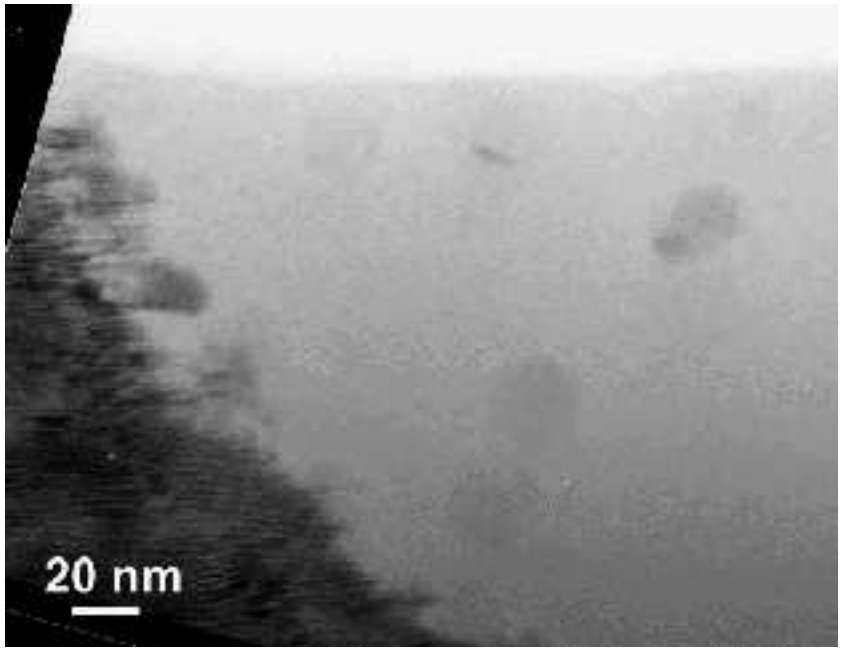


Write + 100 μS erase

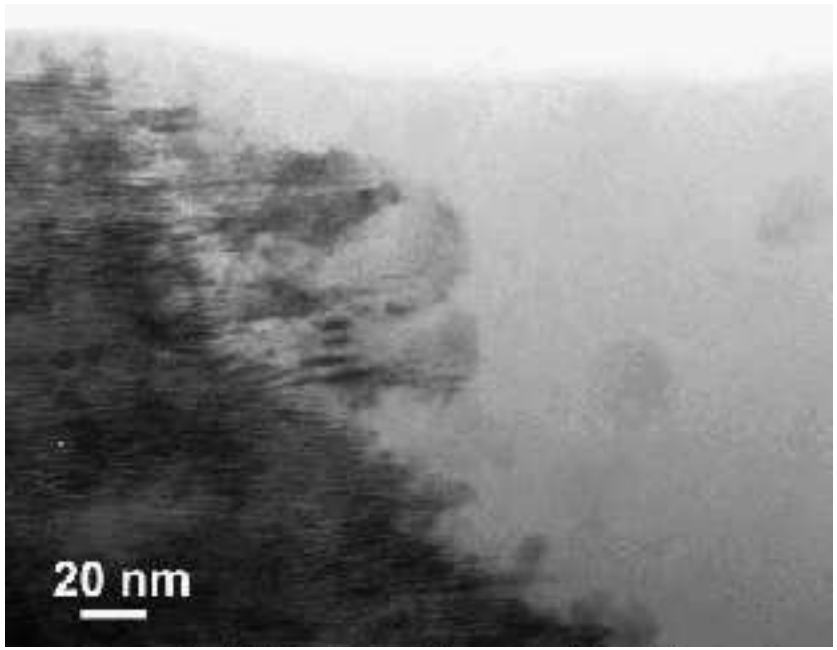
As erase pulse lengthens, bright ring grows inward.

Final mark has larger signal than surrounding matrix.

In Situ TEM Recrystallization Occurs from Mark Edge



Write pulse only



Write + 1 S irradiation

In situ TEM observation of electron-beam exposure suggest re-growth from the edge.

Growth-dominant behavior can occur under some circumstances.

Summary

- High-quality phase-change media films have been grown on Si(111).
- The III-VI semiconductor phase-change media form diodes with reasonable collection efficiency.
- Erasable laser marks give a usable contrast in diode signal.
- Apparent growth-dominant behavior implies short erasure time for small-diameter marks.
- Up to 100 write-erase cycles have been achieved without significant degradation.

More Information

HH2.6 **An Electron-Beam Addressed Phase-Change Recording Medium**, Gary Gibson, HP, 3:45 today.

HH3.7 **Modeling InSe Phase-Change Materials**, Krisztian Kohary, Oxford, 11:30 Tuesday.

GG4.5 **Heteroepitaxy of InSe/GaSe on Si(111) Substrates**, Jacek Jasinski, LBNL, 3:45 Wednesday.

Also a preprint, **Electronic detection of reversible optical recording on epitaxial InSe/GaSe/Si diodes**.