

EP 734 – Energetic Processing of Materials

University of Virginia – Spring 2003

(Preliminary)

Goal: Learn the fundamental science of interactions of energetic ion and laser beams with materials, and technical applications.

Textbook: Lecture notes at <http://www.virginia.edu/ep/Interactions> will be complemented by: *Pulsed Laser Deposition of Thin Films*, edited by D. B. Chrisey and Graham Hubler, (Wiley Interscience, NY, 1994) (available at <http://www.a1techbooks.com>)

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Tests: February 11, April 1, and May 8 (**Final Exam**)

Grading breakdown:	Homework/papers/presentations	50%
	Tests	50%

Tentative Topics:

Ion-Solid Interactions

- I. Collision kinematics. Effect of inelasticity. Classical vs. quantum pictures. Excitation, ionization and charge exchange. Adiabatic rule. Curve crossing.
- II. Atomic collisions in solids: Monte Carlo and molecular dynamics simulations.
- III. Ion-solid interactions. Stopping power, penetration and ranges. Channeling.
- IV. Radiation damage. Sputtering.
- VI. Ion beam modification of materials, including ion implantation of semiconductors.

Photon-solid interactions

- VI. Photon interactions with matter, from X-ray to infrared photons.
- VII. Electronic excitations of solids. Radiation Damage.
- VIII. Lasers. Laser ablation of materials

Applications to Thin Films

- IX. Laser deposition of thin films
- X. Sputter deposition of thin films
- XI. Ion Beam Assisted Deposition (IBAD) of thin films.