Semiconductor Devices Project Laboratory

How to design, fabricate, and characterize microdevices

Class of spring 2002

Instructors: Scott Manalis and Marty Schmidt
MEMS Project Lab Class

• **Purpose**: To gain experience in designing, simulating, fabricating, and testing a microfabricated device.

• **Format**: ~ 6 students work as a team on a single project.

• Project topic is aimed at advancing current research.
MTL - The Facilities

- Integrated Circuits Laboratory
  - Class 10 - 2800 sq.ft. (6'')
  - 1.25 micron CMOS baseline process

- Technology Research Laboratory
  - Class 100 - 2200 sq.ft. (6'')
  - Flexible Process Environment

- Exploratory Materials Laboratory
  - Class 1000 - 2000 sq.ft.
  - Thin Film Process Facility

- IC Design Laboratory
  - Foundry IC Processes
Organization

- Prerequisites: 6.152 or consent of instructors.
- Class officially meets 1-2 times per week for 1 hour.
- Time commitment is ~15 hrs/week.
- Smaller teams of 2-3 are often created for sub-projects.
- Dropping course mid-semester is not allowed.
- Grades are based on participation, final report, and project outcome.
- Concept of class project is often used for future research.
A History of MEMS Class Projects

- **Fall 1999**: Interferometric Accelerometer
- **Spring 1999**: Silicon Piezoresistive Cantilever
- **Spring 2000**: Interferometric Accelerometer v2 with Custom Photodiodes
- **Spring 2001**: Nanomechanical Biosensor with Interferometric Detection
- **Spring 2002**: Silicon field-effect biosensor
Electronic analysis of DNA by its intrinsic charge

Class of Spring 2002
Integrate microfluidics and microelectronics
Integrating PCR amplification with silicon field-effect sensors for real-time DNA detection

**Instructors:** Professors Scott Manalis and Marty Schmidt  
**Guest Instructor:** Dr. Raj Chakrabarti  
**Advisors:** Maxim Shusteff, Peter Russo and Dr. Paul Benning  
**Prerequisites:** 6.152 or equivalent  
**Time:** TBD  
**First meeting:** September 3 at 1 pm in the Adler Room (39-327)

The project goal for fall 2003 is to integrate PCR, silicon field-effect sensors, and microfluidics for applications that require real-time and point-of-use DNA analysis. In achieving this goal, students will gain first-hand experience with MEMS design, process development, fabrication in the Microsystems Technology Laboratory and device characterization as well as biochemical methods relevant for performing PCR. This course will require ~12 hours per week. Please pre-register by emailing your academic/research background and course schedule for fall 2003 to: scottm@media.mit.edu.

**1998:** Kopp et al. micromachined a chemical amplifier to perform polymerase chain reaction (PCR) in continuous flow at high speed. *(Science 280 1046)*

**2002:** Fritz et al. reported the selective and real-time detection of label-free DNA using a silicon field-effect detector. *(PNAS 99 14142)*

**2002:** The 6.151 class successfully integrated PDMS microfluidics with planar silicon field-effect sensors.