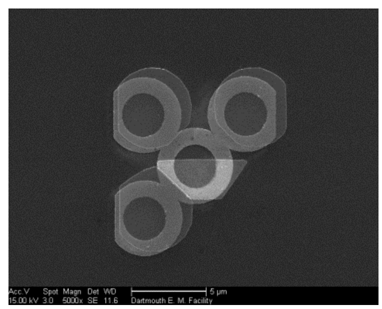
Master's projects

Artificial grain boundaries in silicon
Ursula Gibson, IFY; Jostein Grepstad, IET

Grain boundaries in multi-crystalline silicon (such as that used for solar cell production) accumulate impurities and degrade the electronic and optical properties of the material. In this experimental project, the student will make photolithographic masks to protect a submicron layer of silicon, then measure the effect of ion implantation performed (commercially) through that mask. This will result in three-dimensional confinement of the impurities. Freeware will be used to model the implantation, and electrical transport measurements will be used to characterize the resulting structures. Annealing studies will allow comparison with bulk multicrystalline material. The student should be familiar with computer simulation, experimental work in NanoLab (sample preparation) and electrical characterization. ursula.gibson@ntnu.no

Micromagnetics (collaboration with Berkeley)
Ursula Gibson, IFY

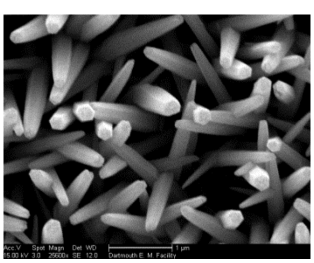


Small magnetic structures linked into complex shapes are being investigated as logic circuits because they require no power to retain their information, and can improve the flow of information in processors by combining memory and active functions. The student involved in this project will build such structures using electron beam lithography and characterize their switching behavior using optical methods. This project is appropriate for a student with good experimental skills, and preferably, some NanoLab experience. An associated modeling project is also possible.
ursula.gibson@ntnu.no

Magnetic interfaces
Ursula Gibson, Erik Wahlström, IFY

Thin film layers deposited onto antiferromagnets exhibit changes in their magnetic properties due to the interaction at the interface. In this project, the student will deposit thin film bilayers and study their magnetic properties optically.

Growth of oxide nanostructures
Ursula Gibson, IFY



ZnO and related compounds are being investigated for the production of ultra-low cost solar cells. This project will examine environmentally friendly methods for the production of nanowires of these materials, using either laser-induced or electrochemical methods. The student will prepare solutions, grow the nanostructures and characterize them using X-ray diffraction, scanning electron microscopy and optical methods; attention to

detail and good experimental skills are required. If time permits, a simple solar cell will be made.
ursula.gibson@ntnu.no

Self-assembly of microwires
Ursula Gibson, IFY
Small particles behave differently at the microscale, and this project will investigate the assembly of small cylinders into regular arrays, using surface tension and electric fields. The student will use photolithography to create electrode structures that drive assembly of cylinders into regular arrays. Characterization and some processing will be performed in NanoLab.
ursula.gibson@ntnu.no

Semiconductor fibers
Ursula Gibson, IFY (collaboration with Clemson University)
Optical fiber techniques are being adapted to make quasi one-dimensional structures of semiconductors. These have potential applications as optical waveguides, as solar cells and optoelectronic devices. The student will participate in the fabrication and analysis of these new materials.

X-ray photoelectron spectroscopy of solar materials
Ursula Gibson, Turid Reenaas, IFY
Density functional theory has predicted the presence of a partially occupied band inside the bandgap of some semiconductors, and these represent promising candidates for improved solar cells. The student will participate in the production and electronic characterization of these materials.