Application of Colloidal Lithography for Micro/Nano Surface Structuring

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INTRODUCTION
Micro technology has many applications within the cleantech area. Well known examples are micro fabricated solar cells relying on silicon substrates and fabrication technologies. Such systems have been in use for many years and currently the number of systems in use in Denmark is increasing rapidly.

However, micro and nano technology can help overcome the future challenges in many other different ways. Sensing systems can increase the output of wind turbines and sensors of different kinds can help to save energy. Small Lab-on-a chip devices can perform environmental analysis and detect pesticides. Other applications are energy harvesting from vibrations, which can provide energy to embedded sensing systems that can help save energy or monitor for example the conditions of wind turbines.

TOPICS ADDRESSED
This project is the collected effort from four courses at DTU Nanotech:
- 33471 Nano-3W: Experimental Micro- and Nanotechnology
- 33470 Mikro-3W: Experimental Semiconductor Technology
- 33435 LabChip-3W: Experimental Work on Lab-on-a-chip Systems
- 33422 Nanolithography

The topics addressed are:
- Carbon nanotube based system for environmental analysis
- Lab-on-a chip device for pesticide detection using gold nanoparticles
- Inorganic electrets for energy harvesting devices
- Application of Colloidal Lithography for Micro-/Nano Surface Structuring
- Use of electron beam and nanoimprint lithography for cleantech

RESULTS
As the projects will be carried out in June 2012 the results cannot be presented yet. However, the results will demonstrate how useful and versatile micro and nanotechnology is.

Universal charging from PV

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INTRODUCTION
This project has been a part of the course 31015 Introductory project. The general purpose has been to charge a lead acid battery (12 V or 24 V) from a photovoltaic panel, by the use of a Maximum Power Point Tracking (MPPT) system and a DC/DC converter. Secondly the aim has been to investigate the need for MPPT in reference to the extra cost versus efficiency. This is done by implementing the system on a solar cell lightning column provided by the company Alfred Preiss. Thirdly the criteria of the design have been to make the system as cheap and universal as possible. Hence this PV charging system could be a proper alternative for diesel/gas generators in countries without central power supply. Our aim has been the African countries.

THEORY
We have primarily used skills obtained in the course, Power electronics. The first issue was to find the proper type of DC/DC converter. Our goal from the beginning was to make the converter as universal as possible. With this in mind we chose to go for the Single-ended primary-inductor converter (SEPIC). A SEPIC converter has the advantage of being able to boost the input voltage or to buck the input voltage, which is exactly what we had in mind for our device. Then we calculated the ideal sizes and properties of the components (inductors, capacitors, Schottky diodes and transistors) from the equations, derived from the circuit analysis and in reference to the theory of Mohan (2012).

METHODS
The SEPIC converter was built by hand step for step. Since we did not have any proper sized inductors, we made them by ourselves. The MPPT algorithm was written in the C programming language, and was configured on the microcontroller (type of dsPIC3F) by a PICKit device.

RESULTS
Results obtained from the first test drive on the 20th of April 2012. The test was performed with a regular power supply instead of the actual PV. For seven different input voltages and currents the average efficiency of the device was 87 % (our goal 75 – 85 %).

CONCLUSION
So far the device has been working with a higher efficiency than expected, though these results have been obtained with a “false” PV panel. The final results will be obtained in the three-week period in June. Regarding the final results we will hopefully be able to present these on the 22th of June.

REFERENCES