

## Hot electrons improve catalysis

Soon she will finish her PhD and Gunver Niensens project has potential to improve processes in the chemical industry. In the future chemicals can be produced “on the spot” due to the use of “hot” electrons.



*Foto: PhD student Gunver Nielsen in front of Ultra High Vacuum chamber.*

Gunver Nielsen is doing her PhD at Center for Individual Nanoparticle Functionality (CINF) at The Technical University of Denmark. In her PhD project, she works with catalysis and more precisely on how to enhance surface reactivity of substances by means of hot electrons.

- Hot electrons are called hot because their energy lies above the energy level of the thermal electrons in the material. And hot electrons have a great potential for enhancing the surface reactivity of the catalyst, also at room temperature, says Gunver Nielsen.

Her system consists of a MIS structure. MIS stands for Metal-Insulator-Semiconductor structure. The metal film on top acts as the catalyst. These structures will emit hot electrons when biased and the hot electrons will tunnel from the metal catalyst into the surroundings and into molecules adsorbed on the catalyst.

The main focus in her project is surface physics and therefore measurements are performed in ultra-high vacuum chambers. The very low pressure helps to keep the surface of the catalyst clean and well defined. It also enables her to measure the energy distribution of electrons emitted from the semiconductor components without them being lost when colliding with gas molecules.

- We try to develop a general concept for catalysis and our results look promising. I can control the energy level of the hot electrons depending on the voltage I supply. And in my system reactions that normally need high temperature to take place, can take place at room temperature due to the use of hot electrons, says Gunver Nielsen.

She thinks that in the future the chemical industry can benefit from her work when producing chemicals that are difficult to produce or chemicals only needed in small amounts.

- In the future it might be possible to produce chemicals on a chip when and where it is needed. Imagine, you place a small chip next to your plant and the chip releases the fertilizer ammonia, says Gunver Nielsen.