UC DAVIS
COLLEGE of ENGINEERING

Joint Seminar between CHE, MAE, and BAE

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Visiting Scholar at Brigham Young Univ.

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Noon in 1065 Kemper Hall

Combustion Generics & Towards Selective Oxidation

The United Nations long-term climate goal of a maximum 2°C global surface temperature rise will require a tremendous reduction in CO_2 emissions starting in the very near future. Sweden has stated ambitious targets for the reduction of the national CO_2 emissions; zero emissions should be achieved by 2050. This is a tremendous technical, economic and political challenge, and even more so globally. All sectors need to be addressed in this challenge, although special emphasis will be required for heat and power generation, transportation, and, heavy industries (cement, iron & steel, petrochemical, pulp & paper, recycling etc). Therefore, to make our emission targets attainable, it is clear that cost-effective technology for achieving negative CO_2 emissions will be necessary. Negative emissions are made possible when CO_2 is separated and turned into a product or stored, and, when the CO_2 originates from biogenic fuels.

To address these urgent needs, a ground-breaking technology has been proposed by the speaker and his colleagues at Chalmers University of Technology (CHALMERS), Sweden. The technology is based on a novel two-step selective oxidation process. The proposed technology will enable ultra-efficient conversion of fuels and chemicals combined with recycling of materials with the potential to enable negative emissions of carbon dioxide and zero emissions of other pollutants. In fact, the aim is to turn - what is today considered as waste or side streams - into useful products. With the selective oxidation process it will be possible to create new energy conversion processes that:

- ✓ Enables highly efficient and flexible conversion of solid fuels, as well as waste streams for combined generation of electricity, gaseous fuels, syngas and

steam for use in e.g. industry or the transportation sector. A variable energy carrier output enables energy storage.
- ✓ Makes it possible to separate the resulting emissions, NO_x, SO_x and CO_2, into pure streams for efficient capture and use as products
- ✓ Has the potential to enable separation of inorganics at different oxidation state for efficient product recycling, mainly metal recovery

The selective oxidation process is currently under construction at the CHALMERS campus in Gothenburg and this talk will give an overview of the project plans, the design, as well as the thermochemical principles of this new technology. This talk will present this novel process and how the scaling process (from lab-pilot-full scale) needs to be performed for large-scale thermochemical processes.

Bio: Klas Andersson is a Professor in Combustion and CO_2 capture technologies at Chalmers University in Sweden. His research is focused on chemistry and transport phenomena in combustion and CO_2 capture processes. The work is based on experimental and theoretic research, which aims to provide generic knowledge on combustion and gas cleaning technologies. The overall objective is to contribute to a reduction of the environmental impact associated with the use of energy in various industrial applications. An important part of the research concerns new processes and solutions that can be employed to achieve drastic reductions in CO_2 emissions, in particular CO_2 capture technologies. The studied applications are mainly industrial and heat and power generation processes.
Currently Klas Andersson is a visiting scholar at Brigham Young University; he works together with Professor Andrew Fry (Chemical Engineering Dept.), Professor Brad Adams and Professor Dale Tree (both at the Mechanical Engineering Dept.) to develop the next generation CO_2 capture technologies through advanced combustion and gas cleaning processes.