

## Session: Biofilm application

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### **Productive biofilms on electrode surfaces**

Johannes Gescher

*TU Hamburg, Germany*

Electrode-surfaces are active substrata for biofilm growth as they can be electron donors or acceptors for respiratory organisms. It is our working hypothesis that it will be possible to use electrodes in biotechnological processes either for the production of platform chemicals that are more oxidized compared to their organic substrates, a process that we call anode-assisted fermentation, or that we can build biorefineries based on autotrophic microorganisms that thrive on cathode surfaces. At Biofilms10 I will present recent results on our attempts to build a new autotrophic productive biofilm platform. We isolated an extremophilic knallgas bacterium that has the ability to thrive on cathode surfaces. The organism *Kyrpidia spormannii* grows at pH 3 and 60°C and uses the Calvin cycle for CO<sub>2</sub>-fixation. Growth of the organism on plain graphite cathodes is dependent on the applied potential. We established to quantify electron efficiency of biomass formation as well as the necessary electric power with which the system has to be fueled in order to be productive based on carbon dioxide as substrate. Also we established ways to overcome difficulties in inoculation due to the formation of reactive oxygen species during reactor startup. Laboratory evolution experiments established not only advanced mutants but displayed also biochemical avenues that can be pursued for further targeted strain development. So far we can apply the organism for protein as well as polyhydroxyalkanoate production. To this end we can grow the organism with a variety of off-gases and established triggers to induce PHA production by the organism. Last but not least we established a procedure to partially harvest biomass from the electrodes so that a continuous production process becomes possible.