

In-Situ Measurement of Photosynthesis Using Single *Synechocystis* SP. PCC 6803 in a Microchamber with Gas Barrier Wall

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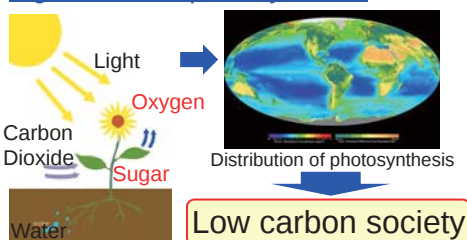
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Attomolar oxygen sensing using fluorescence !!

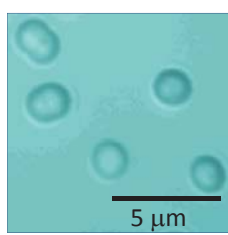
1. Background

Significance of photosynthesis



Synechocystis SP. PC6803

Model bacteria of photosynthesis



Calvin circuit

Aerobic respiration



Photosynthesis



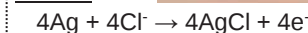
Parameter, $[O_2]$, $[CO_2]$, Lux, Temp...

Electrical oxygen sensor

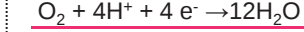
Conventional Oxygen sensor (Hansatech)



Anode



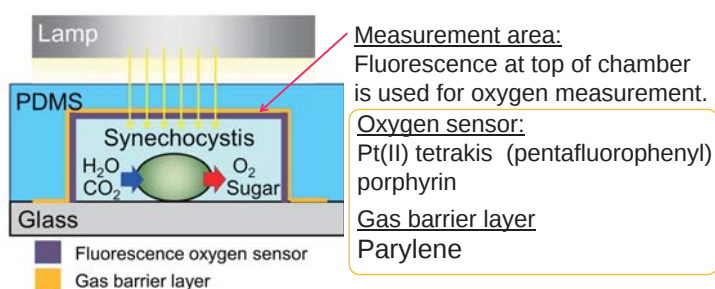
Cathode



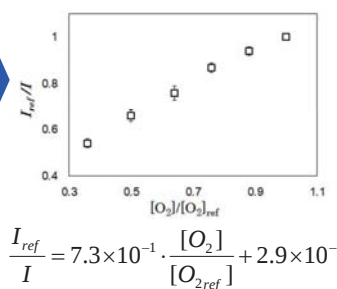
Destruction of oxygen !!

2. Concept

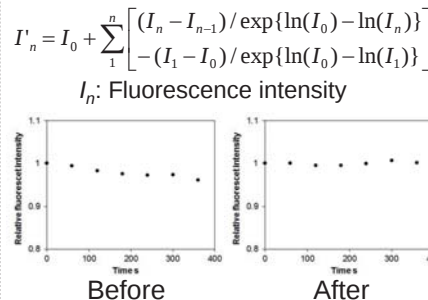
On-chip oxygen monitoring using fluorescent sensor



Oxygen calibration

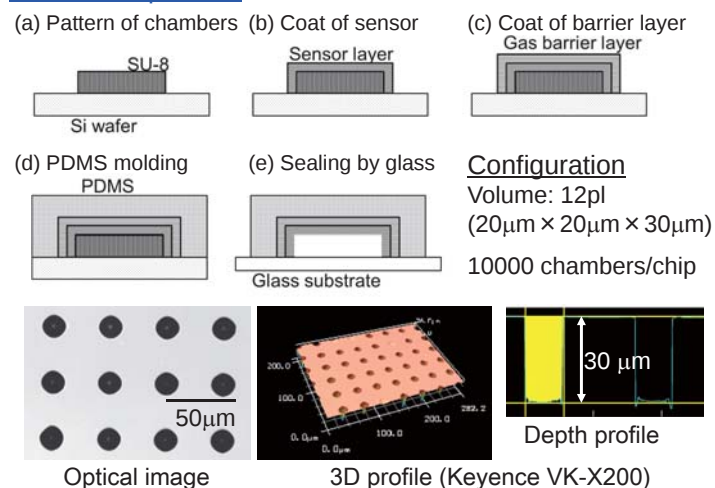


Compensation of photodegradation



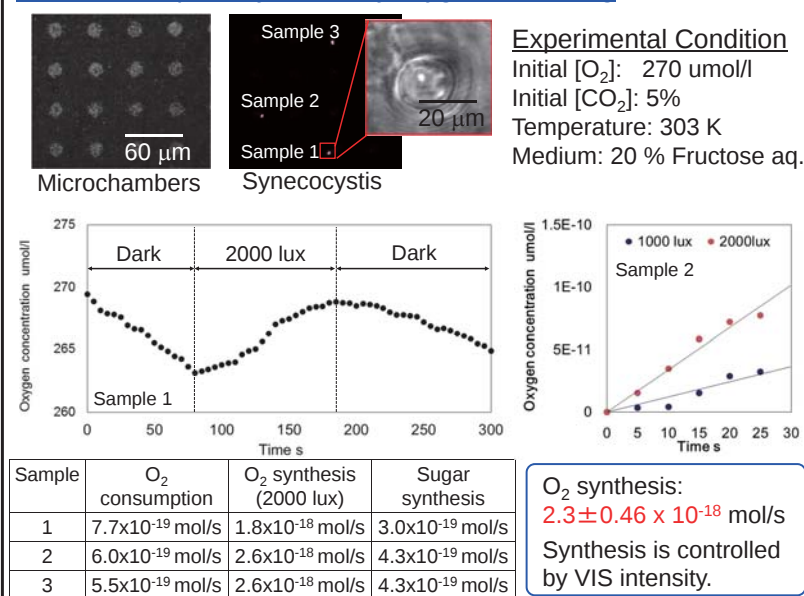
3. Fabrication of microfluidic chip

Fabrication process



4. Experiments

Evaluation of photosynthesis by oxygen monitoring



5. Conclusions and future work

- Evaluation of photosynthesis and aerobic respiration single *Synechocystis* by fluorescent oxygen sensing.
Respiration ratio : $6.4 \pm 1.2 \times 10^{-13}$ μmol/s
Sugar production ratio: $3.9 \pm 0.8 \times 10^{-13}$ μmol/s
- Construction of high-throughput screening system of *Synechocystis* using disruptant of *Synechocystis*.

6. References

Hisataka Maruyama, Yu Matsuda, Tomohide Niimi, Nobuyuki Unozumi, Kei Nanatani, F. Arai, IN-SITU MEASUREMENT OF PHOTOSYNTHESIS USING SINGLE *SYNECHOCYSTIS* SP. PCC 6803 IN A MICROCHAMBER WITH GAS BARRIER WALL, Proc. of Micro TAS 2012 (2012).

Experimental setup

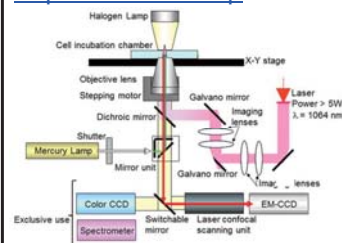


Image acquisition

Laser scanning confocal system:
CSU-X1 (Yokogawa co. Ltd.)
EM-CCD:
iXon Ultra (Andor co. Ltd.)
Excitation wavelength: 561 nm
Exposure time: 1000 ms
Interval: 4000 ms