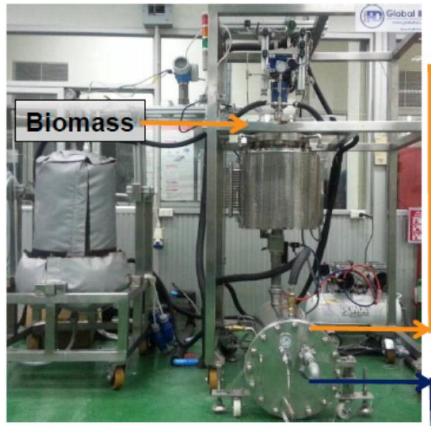
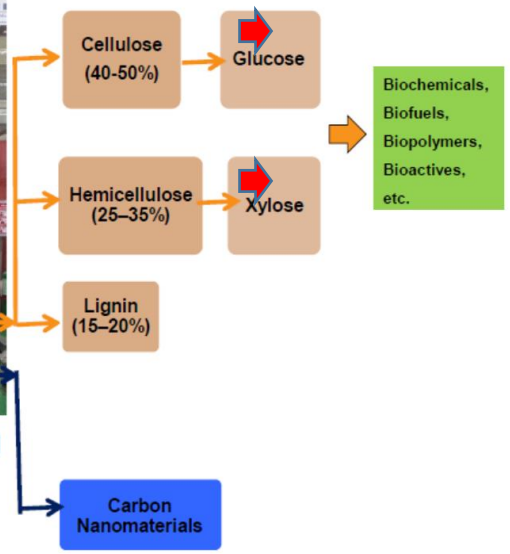
Innovations in Biomass Application for Catalytic Material Synthesis and Energy Devices

NANOTEC CU

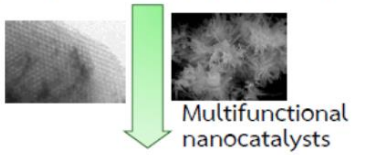
Conversion of biomass to functional materials & fuels



Pre-pilot biomass processing



Palm oil/Animal fat/Biomass derivatives



Packs of high-pressure and low-pressure continuous processes

Catalytic materials for biomass conversion to γ-valerolactone

H_2 storage materials

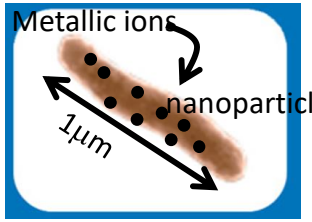
Electrocatalysts for H_2O_2 production

etc.

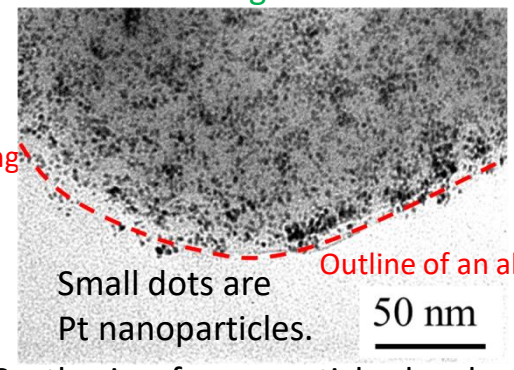
Kyoto U

Algae can reduce metallic ions. => Recover rare metals from wastewater by its beathing.

Human is breathing by taking O_2 and releasing CO_2.



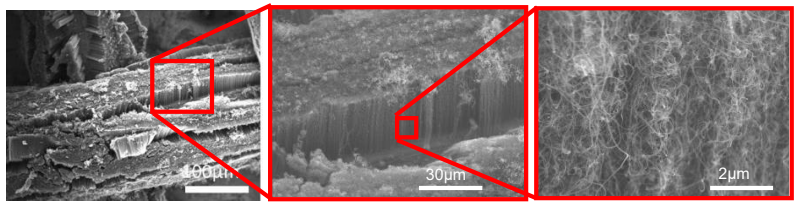
Shewanella algae



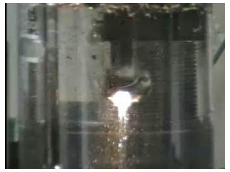
Synthesis of nanoparticles by algae

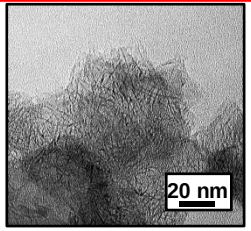
⇒ Application to catalyst (fuel cell, green process, etc.)

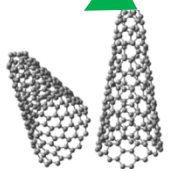
Synthesis of nanocarbons (nanotube, nanohorns)



Carbon nanotubes synthesized directly on stainless steel surface







Synthesis of nanocarbons from natural materials

⇒ Application to hydrogen storage, biodeasel production catalyst

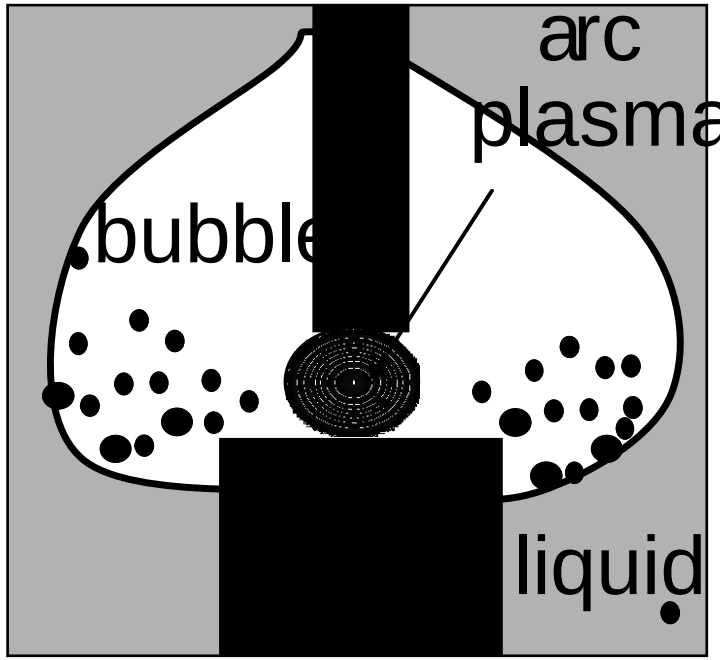
Microscopic images and molecular model of carbon nanohorn

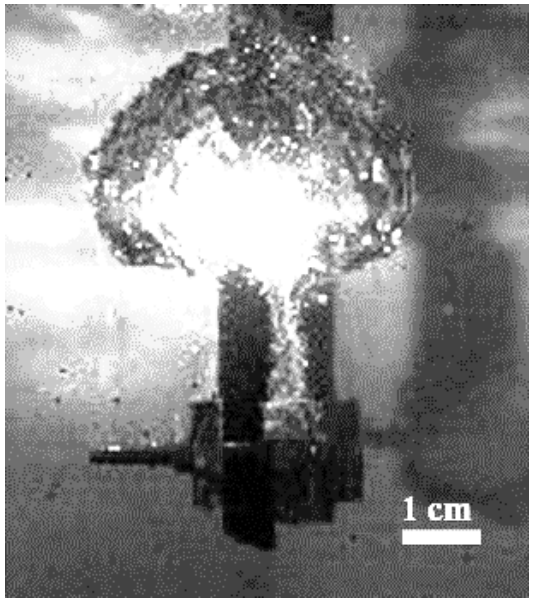
Arc discharge（5000～10000℃！）

Arc discharge in liquid

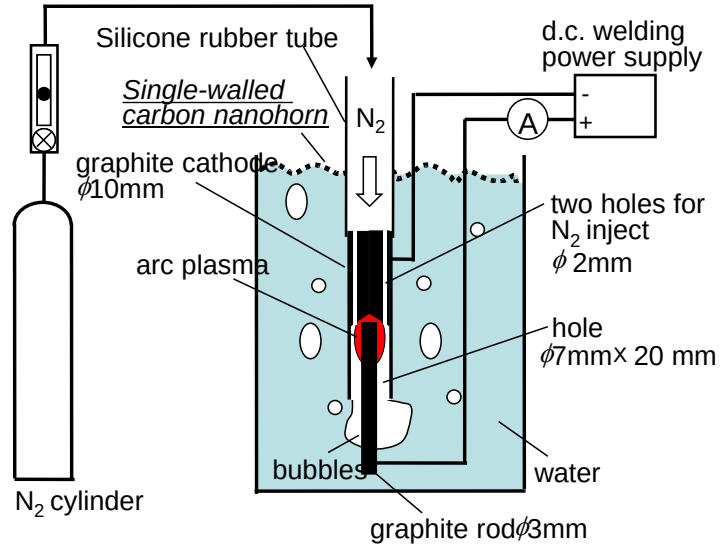
⇒Extreme temperature gap can be easily made.

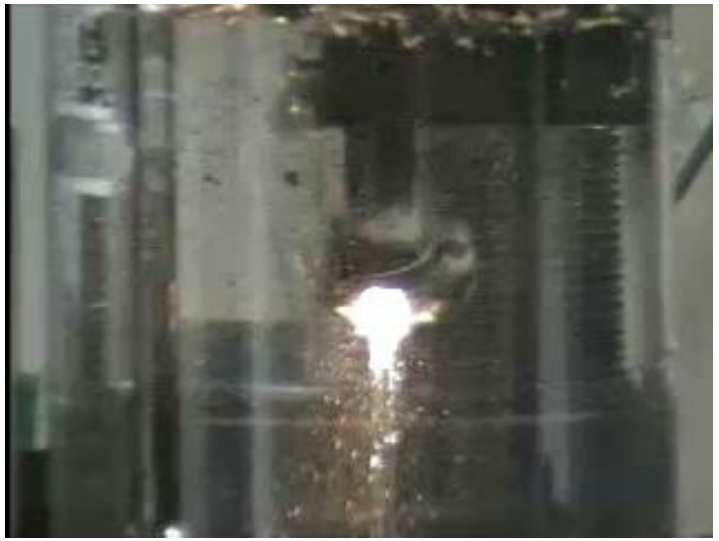
⇒Unique structure can be created!



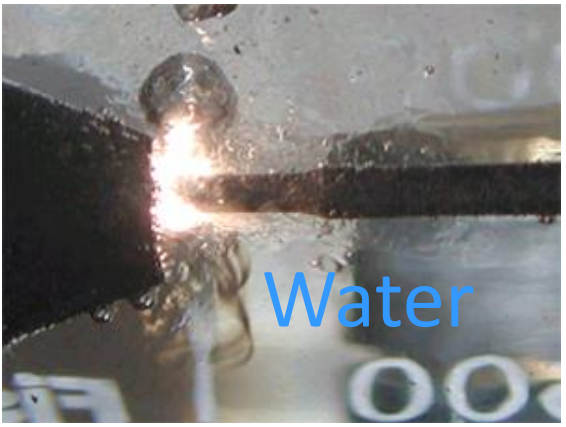


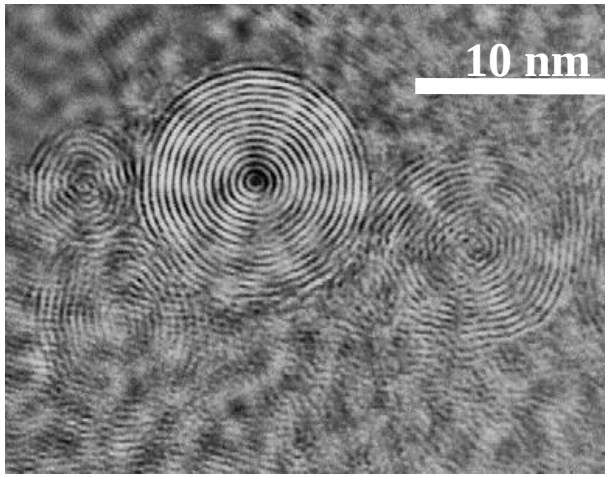
Arc discharge in liquid





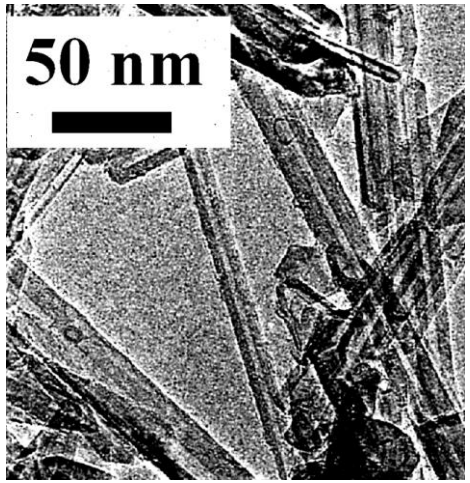
Arc discharge in liquid with gas injection





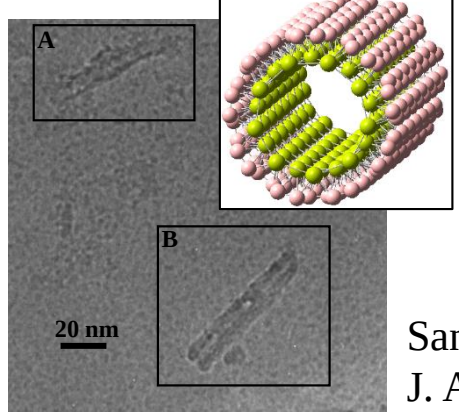
multi-shell fullerne

Sano, et al, Nature, 414, 507 (2001)



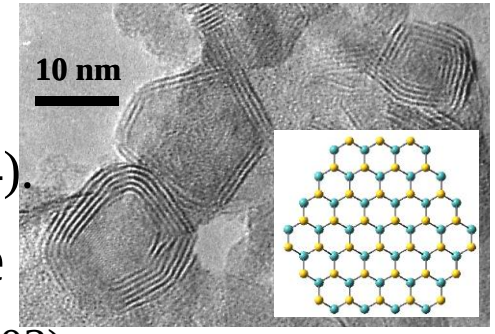
CNT

N. Sano, Carbon **42**, 95 (2004).



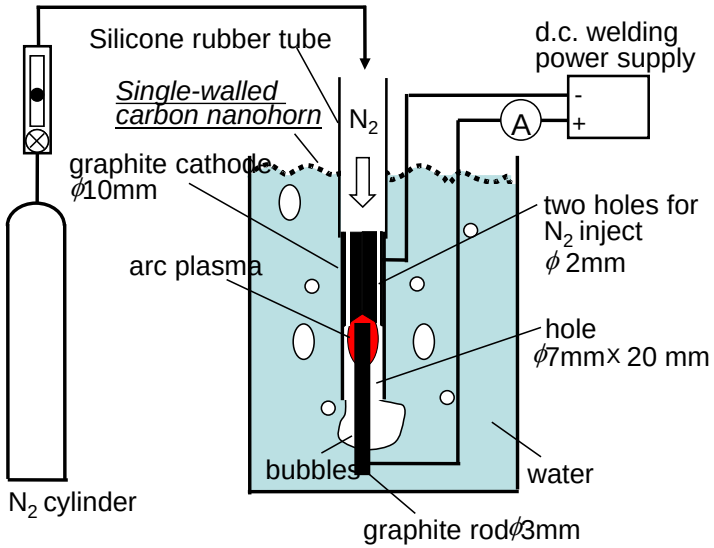
Sano et at.,
J. Appl. Phys. (2011).

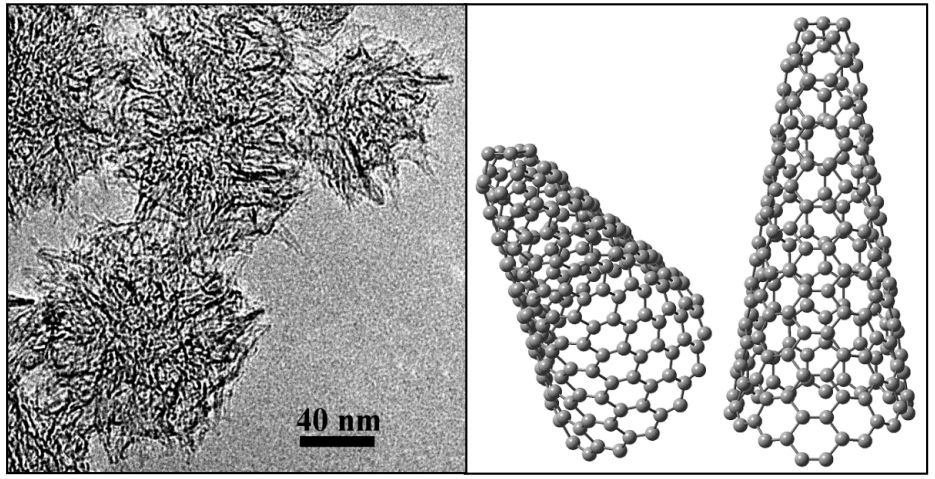
MgB_2 nanotube



N. Sano et al.,
Chem. Phys. Lett. 368, 331-337 (2003).

MoS_2 fullerne

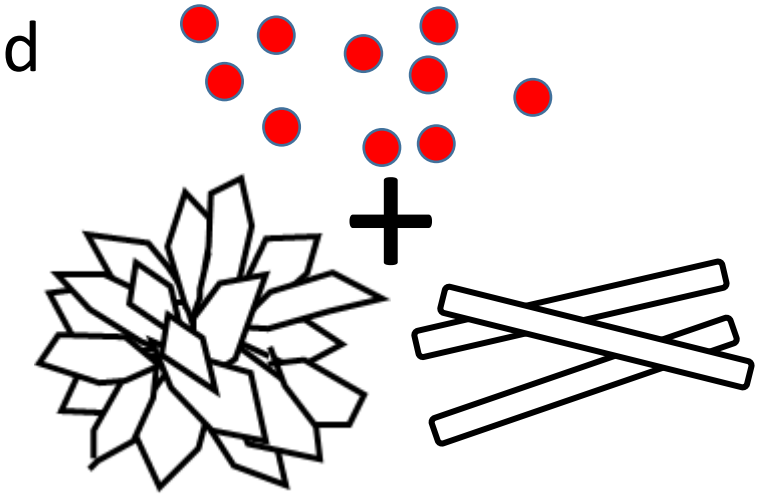




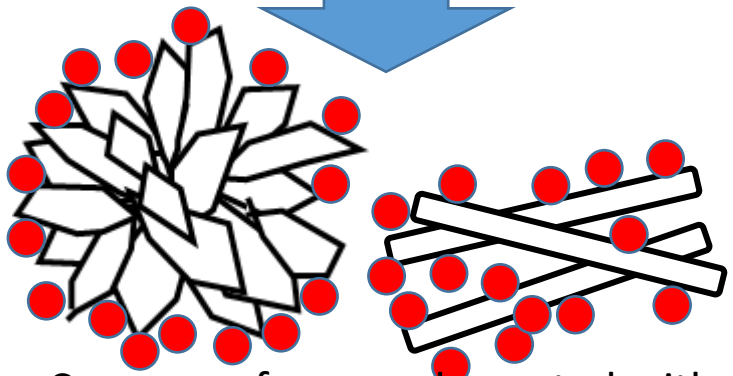
Carbon nanohorn (CNH)

Unique metal-CNH hybrid structures can be realized by GI-AIW method (N also may be doped if N_2 is supplied.)

Conventional functionalization method

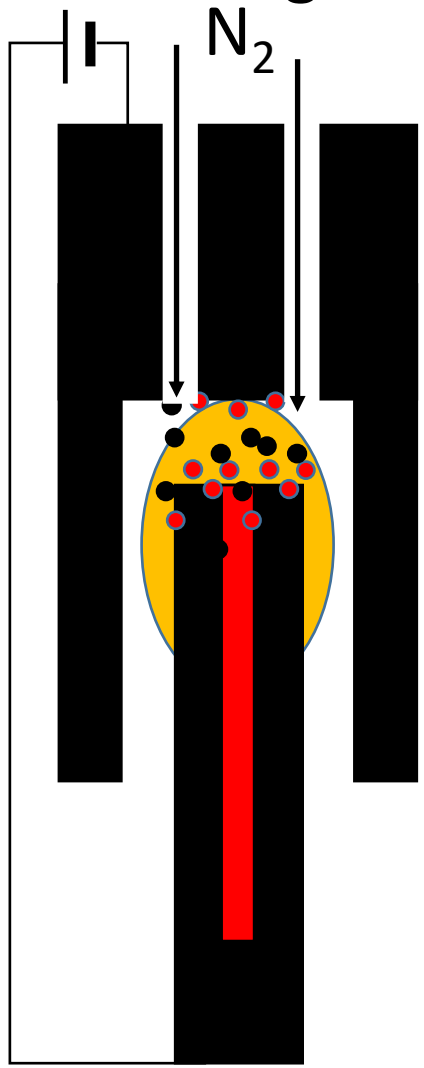


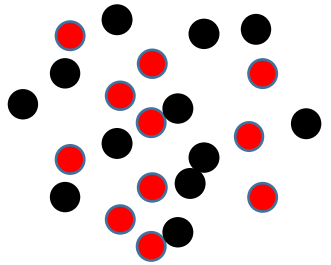
Fe are added on C surface by many ways.



C nano surface are decorated with Fe on outside surface.
('outwall'structure)

Our functionalization method
=> higher catalytic activity is expected.





C and Fe evaporate and are solidified simultaneously.

Fe nanoparticles can exist in carbon wall.
('inwall' structure.)

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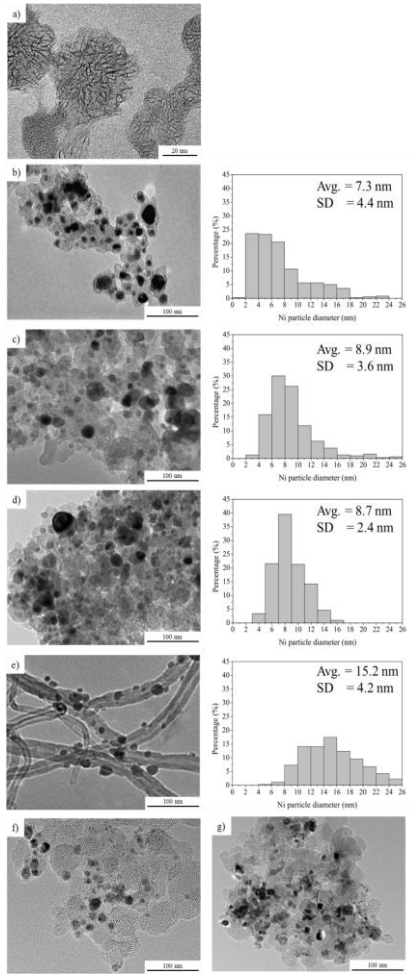
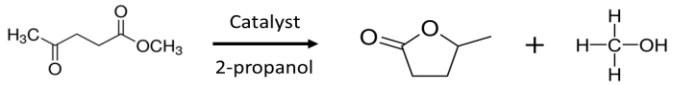
Carbon Nanohorns

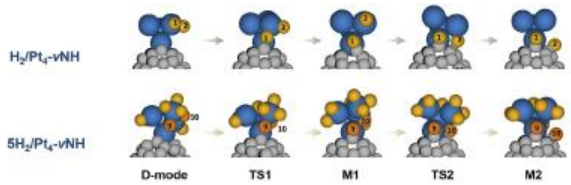


Catalytic materials for biomass conversion to γ-valerolactone



App Surf Sci, 2018

H_2 storage materials



Int Hydrogen Energy, 2018

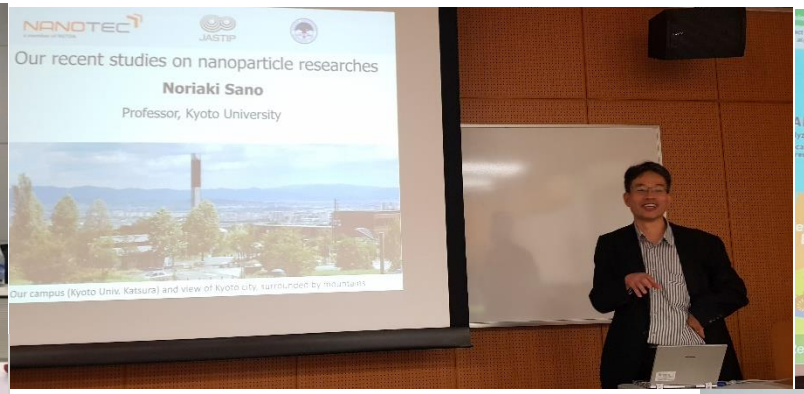
Electrocatalysts for H_2O_2 production

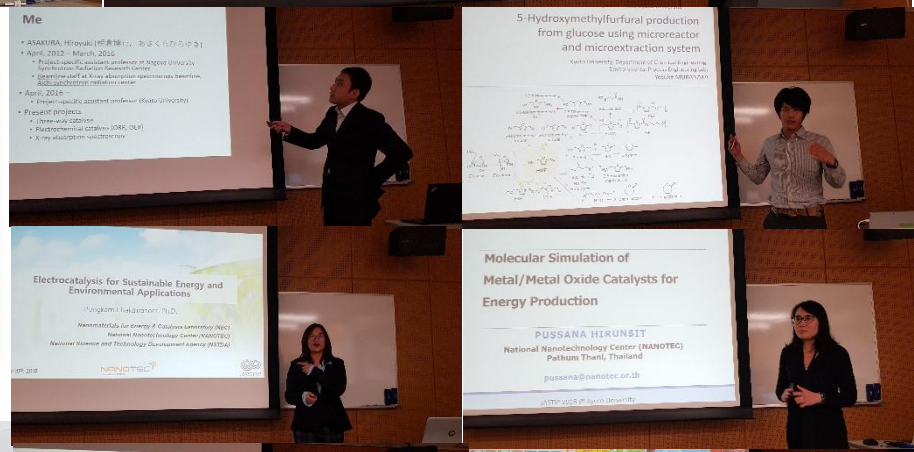
started in 2018, prelim data are positive

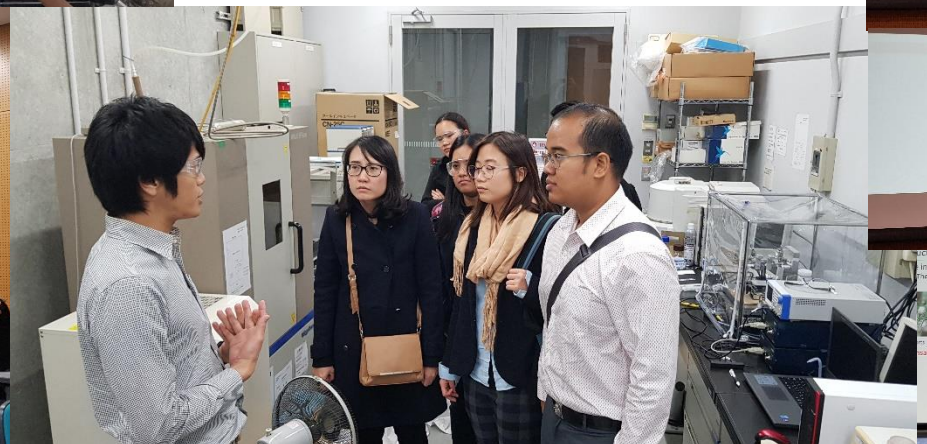
Scientific Output

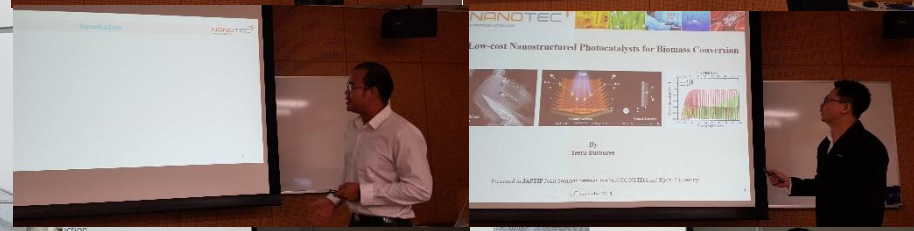
- Int. Journal : 2 papers + 1 submitted
- Int. Conf.: 4 orals
- Two workshops
- 3 exchange researchers/students

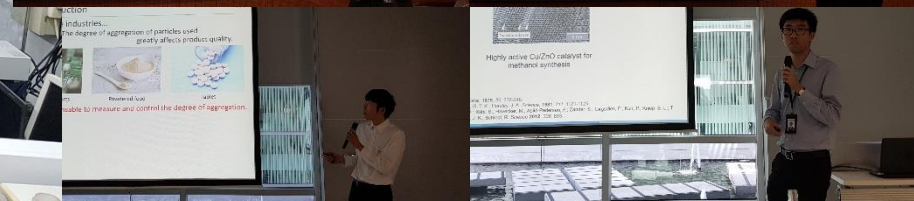
Workshop and Student/Researcher Exchange











Thank you.