

PtNi3 nano fibers and its electrochemical performance in PEMFC

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Background:

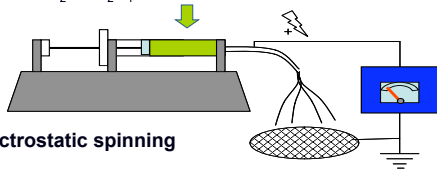
The extremely harsh operation condition in PEMFC (low pH, high potential, brushing of water and vapor) cause:

1. carbon corrosion (the electrode resistance increase, detachment of Pt nanoparticles)
2. catalyst metal degradation (dropping off from carbon support and agglomeration)

Our catalyst strategy----Pt (or its alloys) fibers to overcome above problems.

Issues	catalyst	Pt/C particle	Pt fiber
Carbon support corrosion		Serious problem	No
Pt particle agglomeration		Serious problem	No
High temperature operation		Deterioration accelerated	Could be more stable
Gas and water transportation		Difficult	Could be easier
Durability		stand	longer
Electronic resistance		stand	low

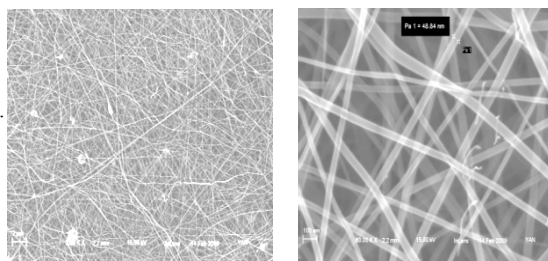
Poly(vinyl pyrrolidone) (PVP)
 $H_2PtCl_6 + Ni(NO_3)_2$
 H_2O / C_2H_4OH



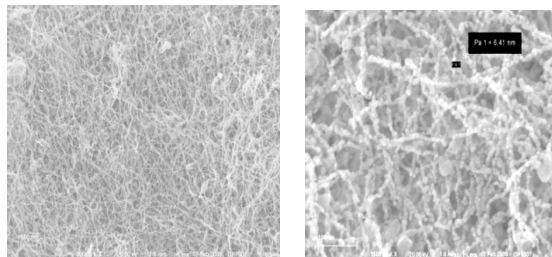
Electrostatic spinning

1. Pt₃Ni alloy nanofiber could be made by electrospinning method, and its diameters range from 5 to 10 nm.
2. Fiber catalyst still has a large active electrochemical area and considerable power output, though its size is larger than commercial Pt particle catalyst.
3. The current densities are still lower from my polarization curves, because optimization is needed in MEA fabrication.
4. We will further decrease fiber diameter and optimize MEA fabrication.

Pt₃Ni Nanofiber Morphology and structure:

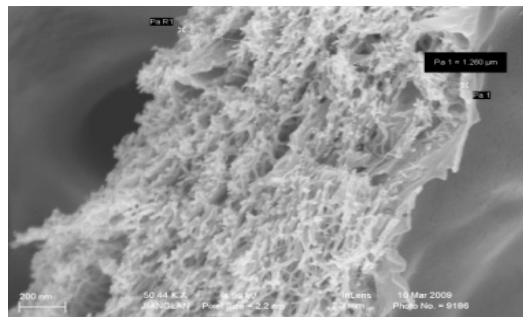


The composite fibers of (PVP+ $H_2PtCl_6 + Ni(NO_3)_2$)

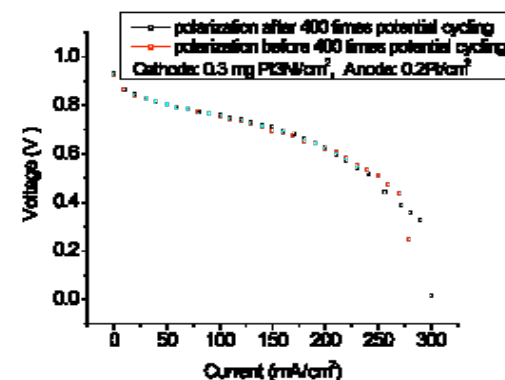


Pt₃Ni nanofibers, 5~10 nm after reduction (350°C/
 $H_2/0.5h$)

Cross section of fiber catalyst film in MEA



Electrochemical performance of Pt₃Ni fiber catalyst



Electrochemical performance of commercial Pt/C catalyst

