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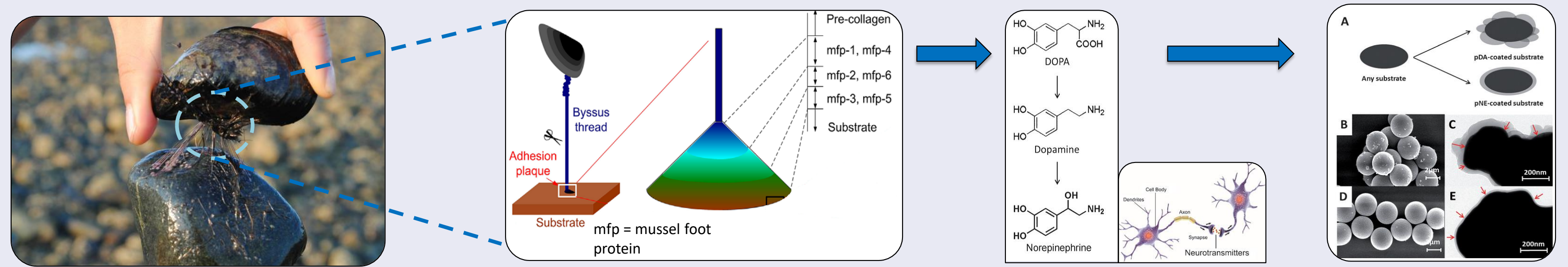
Introduction:

Objectives:

1. Enhance the solid oxide fuel cell (SOFC) performance by incorporating nano-catalyst particles by infiltration within the porous NiO/YSZ anode and LSM/GDC cathode electrodes.
2. Utilize on commercial SOFCs in order show process applicability on existing electrode microstructures.
3. Investigate performance and stability as a function of infiltrated CeO₂ nano-catalyst amount.

Mussel Inspired Adhesives: Dopamine and Norepinephrine

- Catechol based bio-adhesives dopamine and norepinephrine have been utilized to enhance the wetting property of substrates and provides material deposition versatility owing to their multifunctional end groups.
- poly-Norepinephrine offers smoother and more uniform coating than poly-Dopamine.



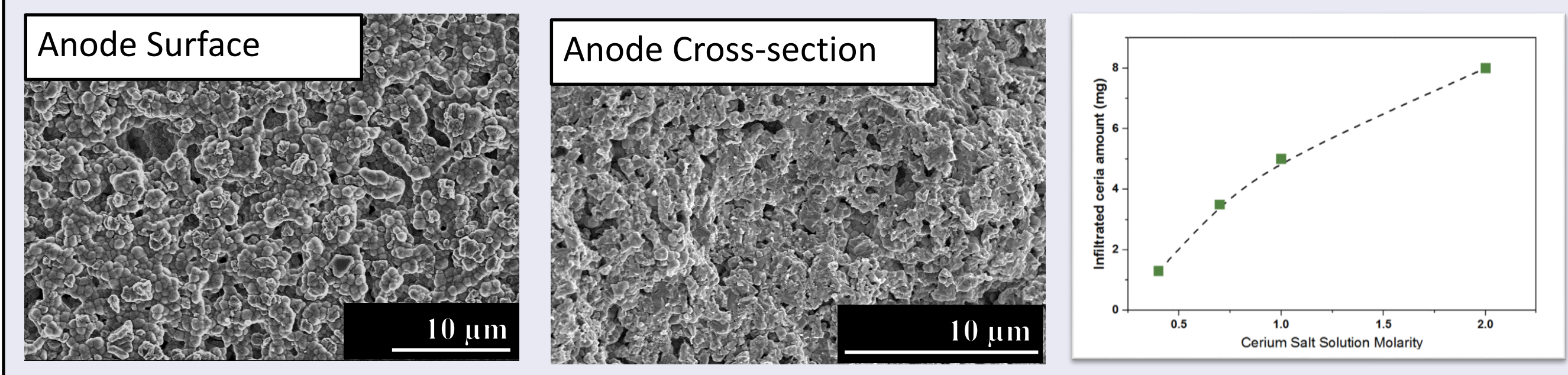
Benefits of Bio-Coating:

1. Independent of substrates and coating composition.
2. Catalyst (or any nanoparticle) can be pinned with the adhesive/chelation mechanism.
3. Facile method to control the overall process (deposition rate etc.)

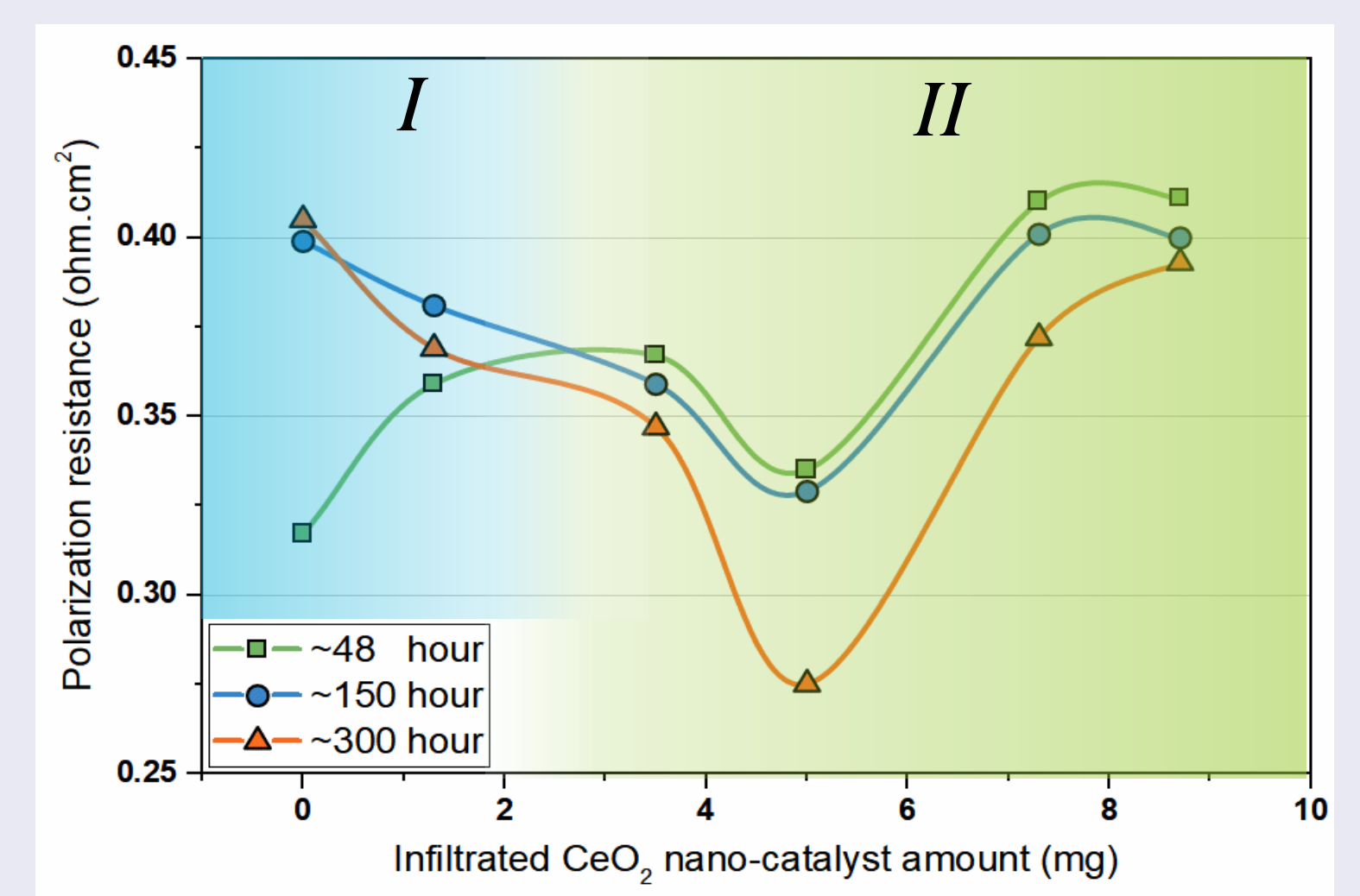
Experimental:

Infiltration Study on Anode-Supported Cells

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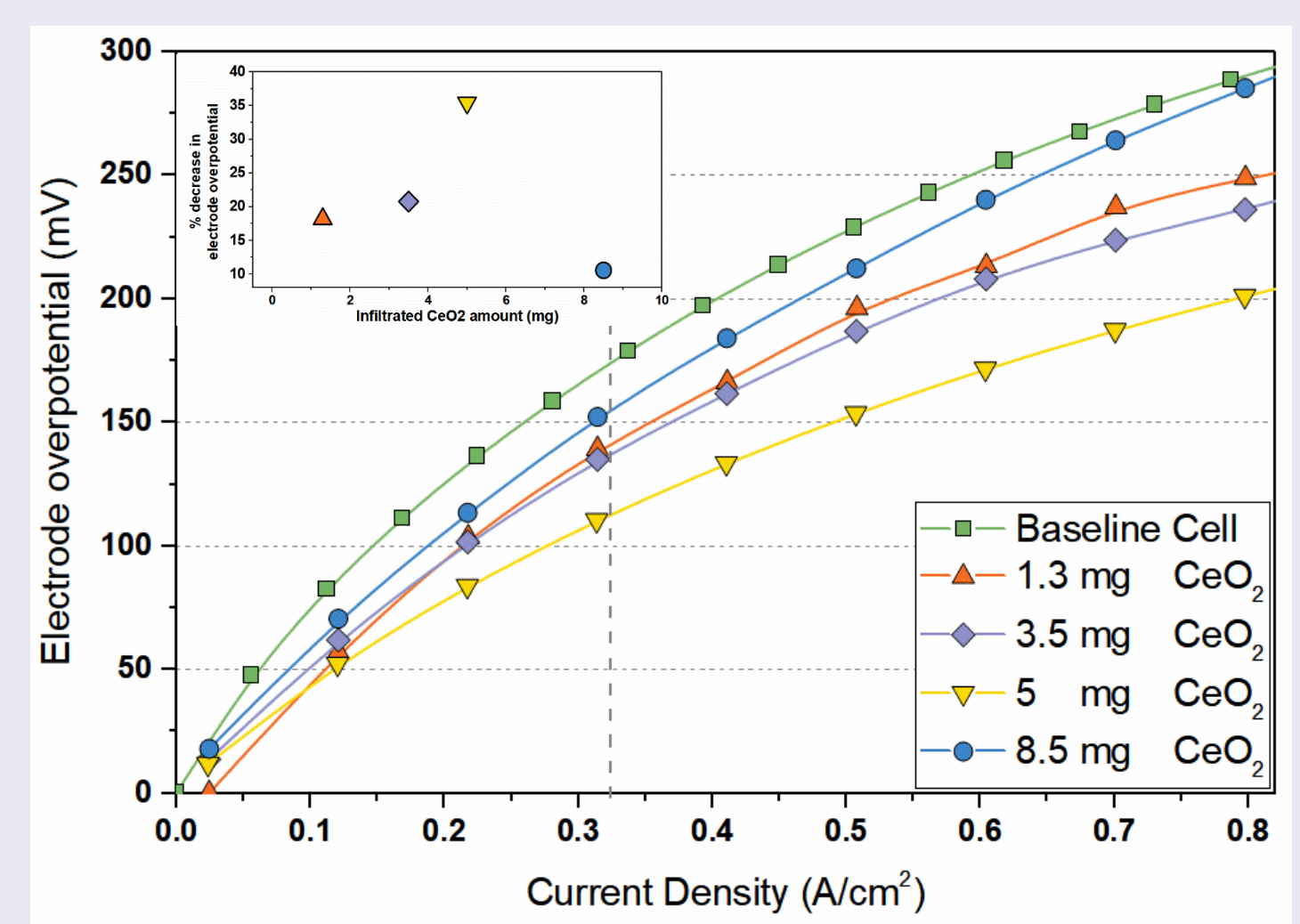


Polarization Resistance vs Nano-Catalyst Amount



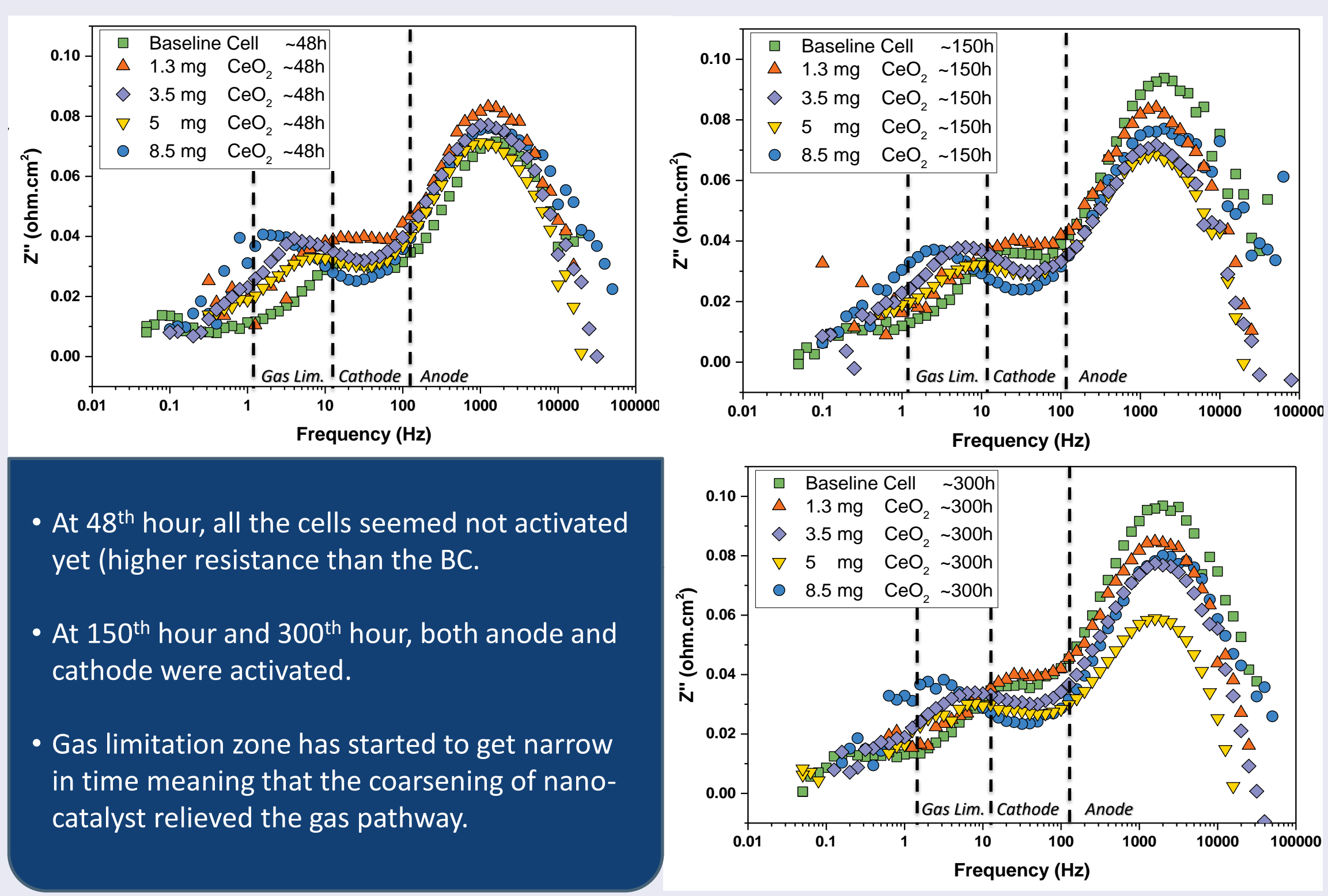
- Two characteristic regions were observed.
- 5 mg nano-ceria infiltrated cell reached the lowest polarization resistance value.
- Above that point, Rp of the cell was close to base-line cell probably due to gas limitation issues.

Electrode Overpotential vs Current Density



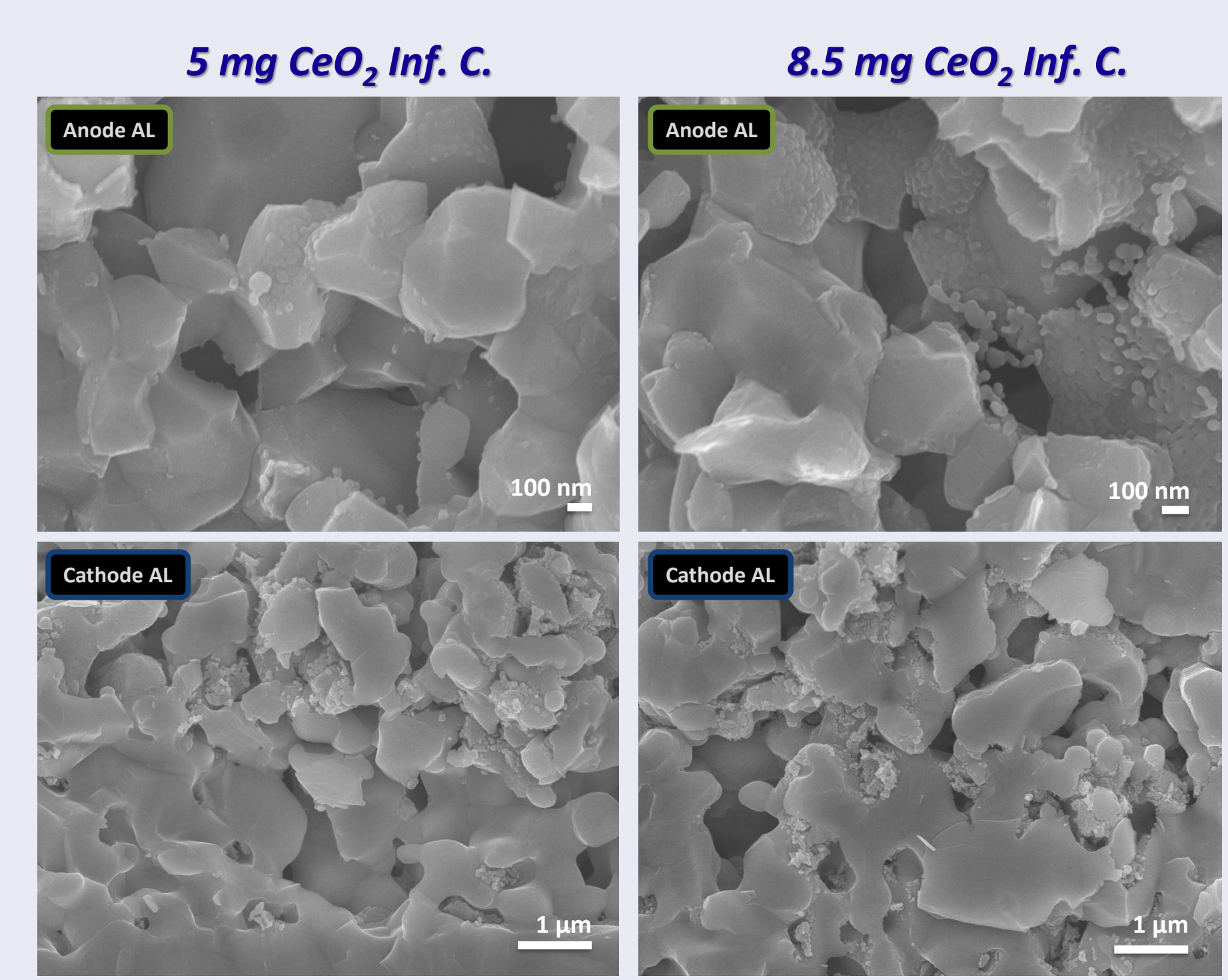
- Electrode Overpotential reduced gradually up to 5 mg nano-ceria loading (up to 35% decrease in electrode overpotential). However at 8.5 mg, the overpotential jumped back just under the baseline cell performance.

EIS Characterization

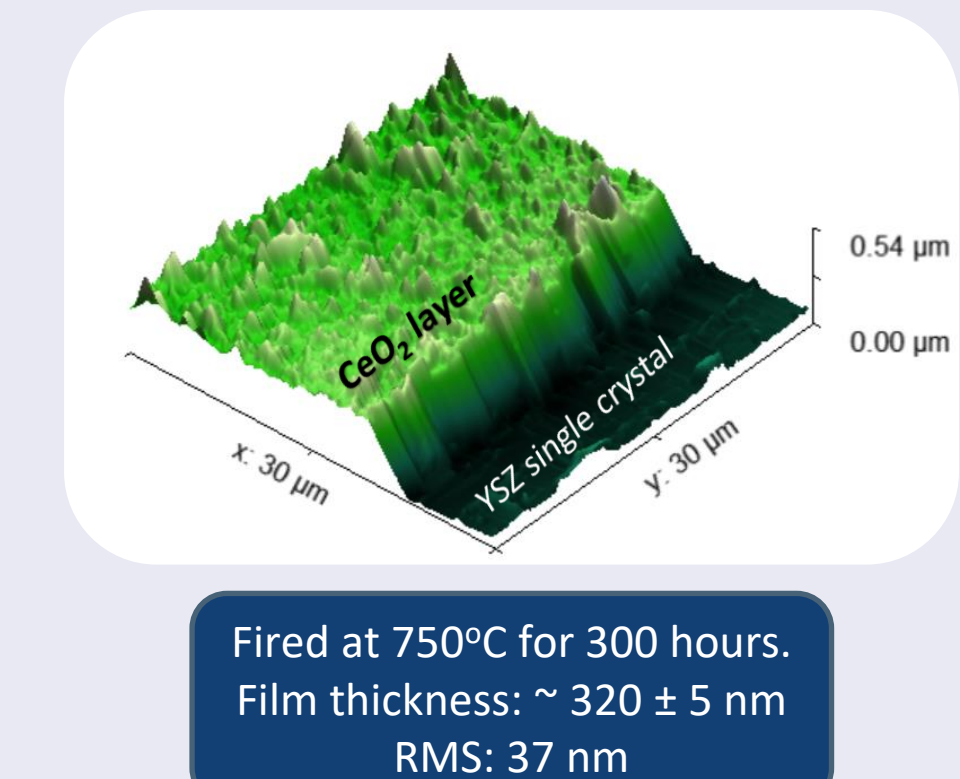
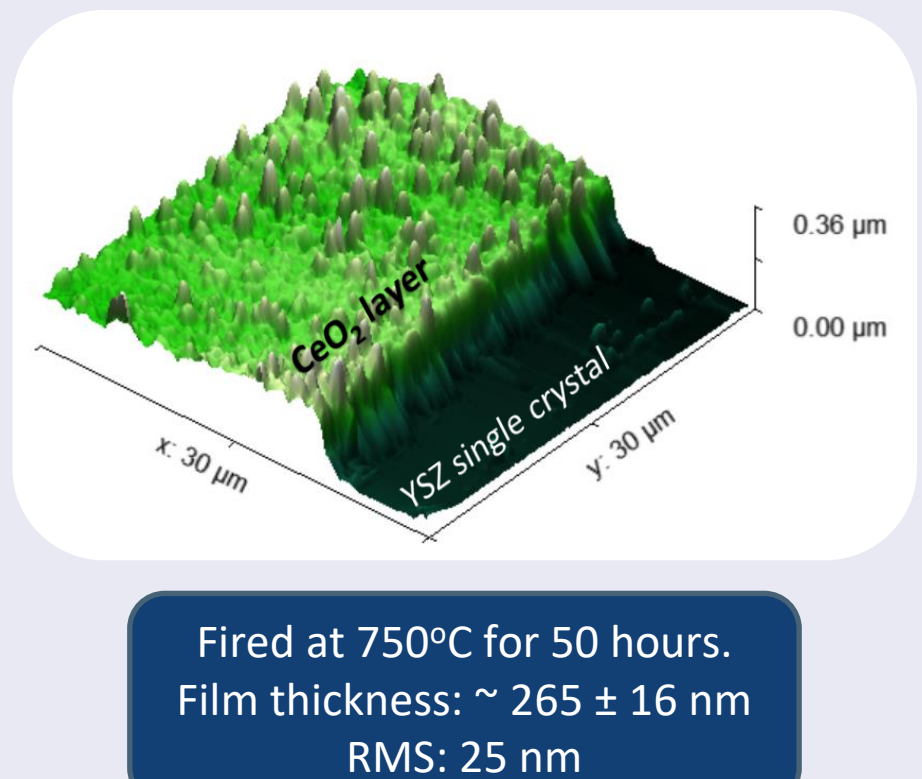
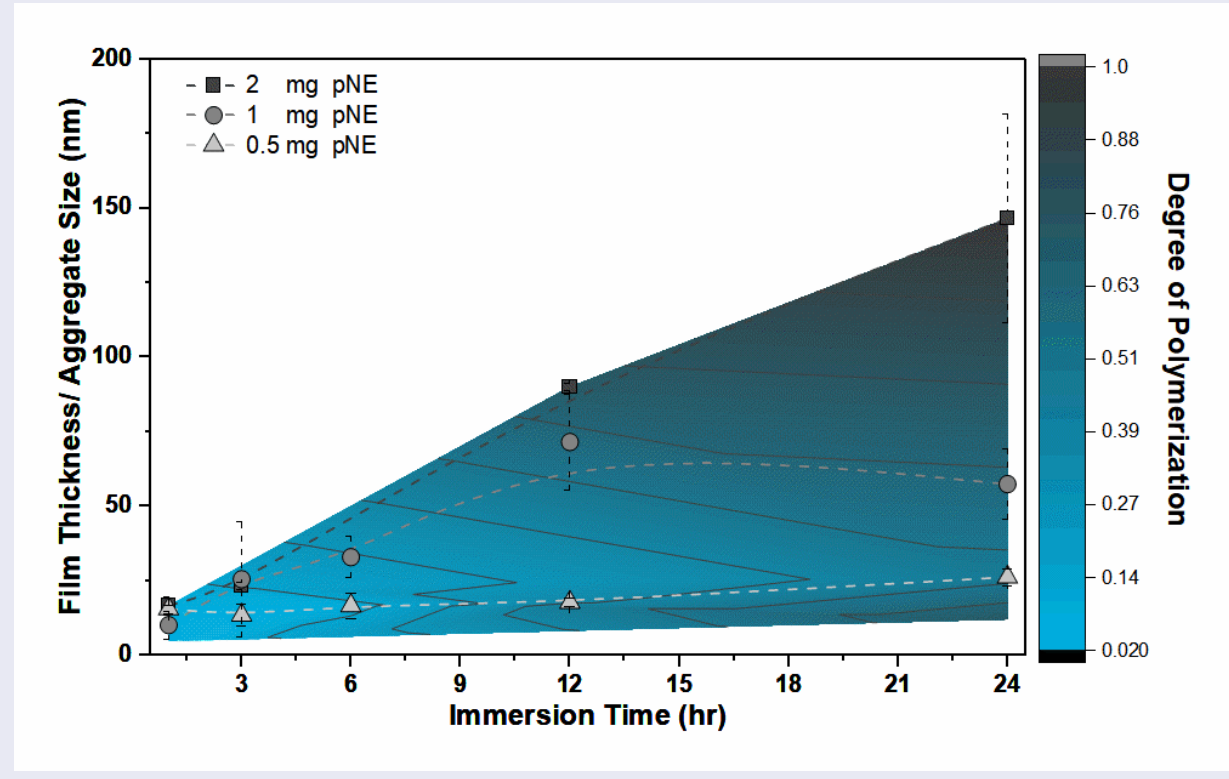


- At 48th hour, all the cells seemed not activated yet (higher resistance than the BC).
- At 150th hour and 300th hour, both anode and cathode were activated.
- Gas limitation zone has started to get narrow in time meaning that the coarsening of nano-catalyst relieved the gas pathway.

SEM Characterization



AFM Characterization



Conclusion:

- poly-norepinephrine dip-coat templating assisted higher nano-catalyst deposition levels.
- A systematic infiltration study was performed to aim the optimum nano-catalyst infiltration needed to get the lowest electrode resistance and overpotential within 300 hours of SOFC testing.
- Both the anode and cathode can be infiltrated at the same time using only a singular impregnation/firing protocol.
- On-going AFM study is aimed to reveal nano-catalyst coarsening kinetics in different deposition decoration (island, thin film formation etc.)

Acknowledgement and References:

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