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New In-situ electron microscopy methods for studying catalysts, electrocatalyst and other functional materials processes

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Catalysis is a key process for converting reactants into products, and it plays a critical role in chemical and energy conversations, and improving catalysis efficiency is essential to reduce our resource and energy consumption. Better understanding of the dynamic processes during catalyst synthesis and use, with detailed information in structural features like facets and surface defects, particle size variances, composition, supporting substances *etc*. is essential for designing more efficient catalysts. In-situ electron microscopy methods can give direct views of these processes with atomic scale spatial and video rate temporal resolution.

SiNx window based in-situ electron microscopy (shown in Figure 1) make it possible to study processes in liquids or gas.

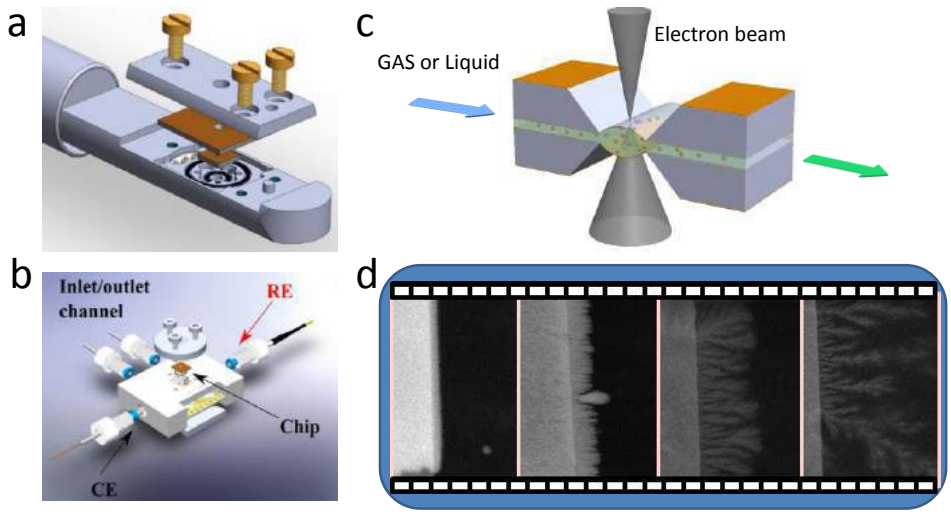

Figure 1, Schematic diagram of a SiNx membrane based chemical/electrochemical cell for catalysis process study, **a**: TEM cell; **b:** SEM cell; **c:** schematic illustration of window region and STEM imaging; **d:** in-situ electrodeposited copper with different morphologies (phosphate tuned) show high formic acid selectivity for CO2 reduction [1].

[1] J. Zhao, S. Canepa, M. N. Yesibolati, K. Mølhave, Z.C.Xu et al, Phosphate tuned copper electrodeposition and promoted formic acid selectivity for carbon dioxide reduction, J. Mater. Chem. A, 2017, 5, 11905