

## Electrochemical quantification of active site density and turnover frequency: from single atom to bulk metal catalysts

최창혁<sup>†</sup>  
광주과학기술원  
(chchoi@gist.ac.kr<sup>†</sup>)

Turnover frequency (TOF) is a key descriptor of heterogeneous catalysts for a valid evaluation of their intrinsic activities. Since the reaction rate depends on the TOF and the catalyst concentration, many efforts have hitherto been made to maximize catalytic performance *via* increasing the number of catalytically active sites (ASD) as well as their TOF. In electrochemical reactions, a special concept of electrochemically active surface area (ECSA) has been alternatively adopted to calculate the ASD due to their very complex local environments. This voltammetric protocol is however restrictively applicable to bulk platinum-group metals, but still challenging for other promising electrocatalytic materials such as atomically dispersed metal catalysts. Herein, a versatile *in situ* method for ASD quantification has been newly suggested by adopting a cyanide anion as a probe molecule. Importantly, this strategy demonstrates its scalable generality to access a variety of the electrochemical conditions from acid to alkaline environments and of the electrocatalytic materials from a series of atomically dispersed metal catalysts to conventional bulk metal nanoparticles.