

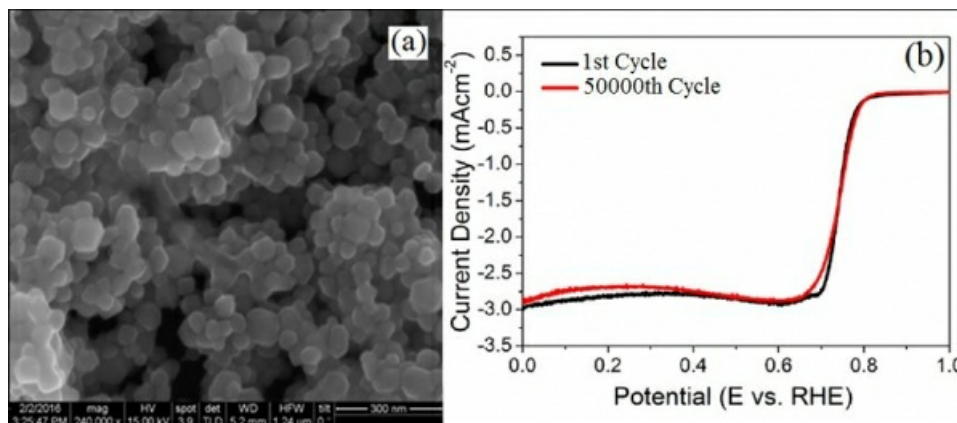
*Structurally ordered transition metal based chalcogenides for oxygen reduction reaction*Saurav Chandra Sarma¹, Sebastian C. Peter¹¹Ncu, Jncasr, Bengaluru, India

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Chalcogenide materials are considered as the promising catalysts for oxygen reduction reaction (ORR).^{1,2} However, their usage is hindered mainly by poor conductivity, which results a substantial decrease in activity upon cycling. Carbon supports such as vulcan and activated carbon generally used to increase the conductivity, but, the issue associated with the stability of the material still not solved. In this work, we have synthesized TM_1xTM_2yXz (TM = transition metal; X = S, Se, Te) nanoparticles with different morphologies (Figure a). The morphology of the particle have also been simulated using BFDH morphology code and exposed planes were extracted. The materials were characterized in detail using various techniques such as PXRD, EXAFS, XPS, TEM and FESEM-EDAX. The electrochemical catalytic activity of the material was checked using vulcan as the conducting carbon support. The material showed good catalytic activity towards ORR and found electrochemically stable even at the end of 50000 cycles with negligible shift in the E1/2 value (Figure b), which is better than the state-of-the-art material platinum on carbon. Better activity of the catalyst has been linked with dissolution of chalcogen from the bulk to the surface of the catalyst. On the surface chalcogen forms XO_3^{2-}/XO_4^{2-} . The presence of chalcogen at the surface has a dual role. Firstly, the oxygen removal process from active sites becomes much easier than without additives. Secondly, hydrogen adsorption and desorption suppresses which prevents the active site from blocking, thus preventing a competitive reaction to take place.

[1] Masud, J. et. al. (2016). ACS Energy Lett., 1, 27-31.

[2] Gochi-Ponce, Y. et. al. (2006). Electrochem. Commun., 8, 1487-1491.



Keywords: [Structurally ordered transition metal based chalcogenides for oxygen reduction reaction](#)