

Transition metal dichalcogenide TiS₂ as electrocatalyst for CO₂ electroreduction

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To date two-dimensional transition metal dichalcogenides (TMDCs) are efficient and selective electrocatalysts for CO₂ reduction to CO, along with MoS₂, WS₂, and their diselenides.[1, 2] Titanium disulfide is impressive due to being a transition metal dichalcogenide and a semimetal with an indirect band gap overlap at the same. Here we show CO electrosynthesis using the atomic layer deposited TiS₂ with a total Faraday yield of 83 % at 0.18 V overpotential at 10 mA cm⁻². We provide mechanistic insights on the electrosynthesis of C=O by the insitu ATR-FTIR spectroelectrochemistry. Paired with mild synthesis protocol, reasonable stability and low-cost production, the TiS₂ semimetal promises satisfying applicability in CO₂ reduction and utilization technology.

[1] P. Abbasi, M. Asadi, C. Liu, S. Sharifi-Asl, B. Sayahpour, A. Behranginia, P. Zapol, R. Shahbazian-Yassar, L.A. Curtiss, A. Salehi-Khojin, Tailoring the edge structure of molybdenum disulfide toward electrocatalytic reduction of carbon dioxide, *ACS nano*, 11 (2016) 453-460.

[2] M. Asadi, K. Kim, C. Liu, A.V. Addepalli, P. Abbasi, P. Yasaei, P. Phillips, A. Behranginia, J.M. Cerrato, R. Haasch, P. Zapol, B. Kumar, R.F. Klie, J. Abiade, L.A. Curtiss, A. Salehi-Khojin, Nanostructured transition metal dichalcogenide electrocatalysts for CO₂ reduction in ionic liquid, *Science*, 353 (2016) 467-470.