Enhancing alkaline media nitrogen reduction reaction through formation of 2D/2D hybrid structures of MoS_2/rGO

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Given the challenging task of constructing an efficient nitrogen reduction reaction (NRR) electrocatalyst with excellent ambient condition performance, properties such as high specific surface area, fast electron transfer, and design of the catalyst surface, constitute a group of key factors to be taken into consideration to guarantee outstanding catalytic performance and durability[1]–[3]. Thereof, this work investigates the contribution of the 2D-2D heterojunction interface between MoS_2 and reduced graphene oxide (rGO) on the electrocatalytic synthesis of NH_3 in an alkaline media. The results revealed remarkable NRR performance on the MoS_2@rGO 2D-2D hybrid electrocatalysts, characterized by high NRR sensitivity (Faradaic Efficiency) of 34.7 % with NH_3 yield rate of 3.98 ± 0.19 $mg.h^{-1}.cm^{-2}$ at the overpotential of -0.3 V vs RHE in 0.1 M KOH solution. The hybrid electrocatalysts also exhibited selectivity for NH_3 synthesis against the production of hydrazine (N_2H_4) by-product, excellent hindrance of the competitive hydrogen evolution reaction (HER), and good durability over an operation period of 8 h. In hindsight, the study presented a low-cost and highly efficient catalyst design for achieving enhanced ammonia synthesis in alkaline media via the formation of defect-rich ultrathin MoS_2@rGO nanostructures, consisting predominantly of HER-hindering hexagonal 2H-MoS_2 phase.

References

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Figures

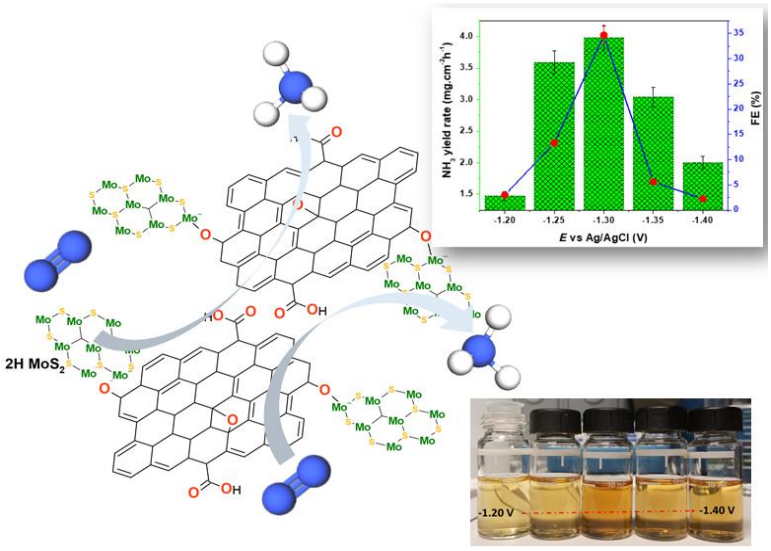

Figure 1: Graphical presentation of NRR process on MoS_2@rGO hybrid nanocatalysts.