Generation of oxide surface patches promoting H-spillover in Ru/(TiO_x)MnO catalysts enables CO_2 reduction to CO

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Gas-driven reconstruction is an attractive and precise strategy to tune sub-nano even atomic structure for catalysts. The migration of reducible metal oxides (especially for TiO_2) to the surface of metal nanoparticles can inhibit the sintering but has a strong negative impact on the catalytic activity. Herein, we reveal the *in-situ* creation of TiO_x patches over the MnO support to generate effective transport channels for H-spillover to transport it from the Ru nanoparticles to the MnO sites responsible for reducing CO_2 to CO, a key reaction for CO_2 conversion to high-value chemicals. The Ru/(TiO_x)MnO (Ru/Ti/Mn) catalyst shows a 3.3-fold increase in reverse water gas shift (RWGS) performance compared with conventional Ru/MnO_x catalysts (Fig. 1a) due to the enhcanced H-spillover (Fig. 1b). Through a combination of physicochemical methods, including *in-situ* studies, catalytic and kinetic data, and theoretical modelling, we demonstrate that the oxide-oxide interfaces are spontaneously generated during reductive treatment in H_2 at temperatures below 500 °C and are responsible for the increased activity (Fig. 1c). The results open new perspectives for the design of novel selective hydrogenation catalysts via the *in-situ* creation of oxide-oxide interfaces acting as H species transport channels.

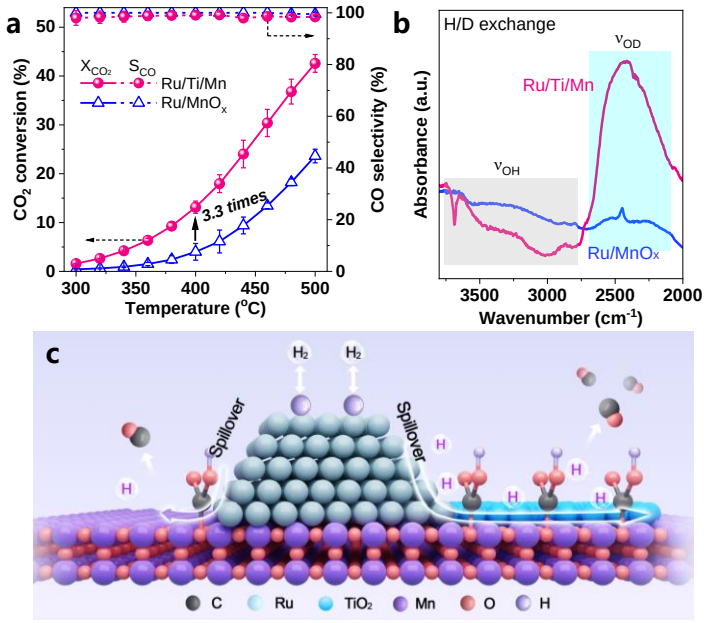

Figure 1. a, CO_2 hydrogenation performance for Ru/MnOx and RuTiMn. **b,** H-D exchange DRIFTs and **c,** TiO_2/MnO interface as effective H transport channel accelerate CO_2 to CO.

References

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