Supplementary Information

Dynamic Structural Evolution of 2D/3D MoS_2@Ni Heterostructure supported on SBA-15 during CO_2 hydrogenation

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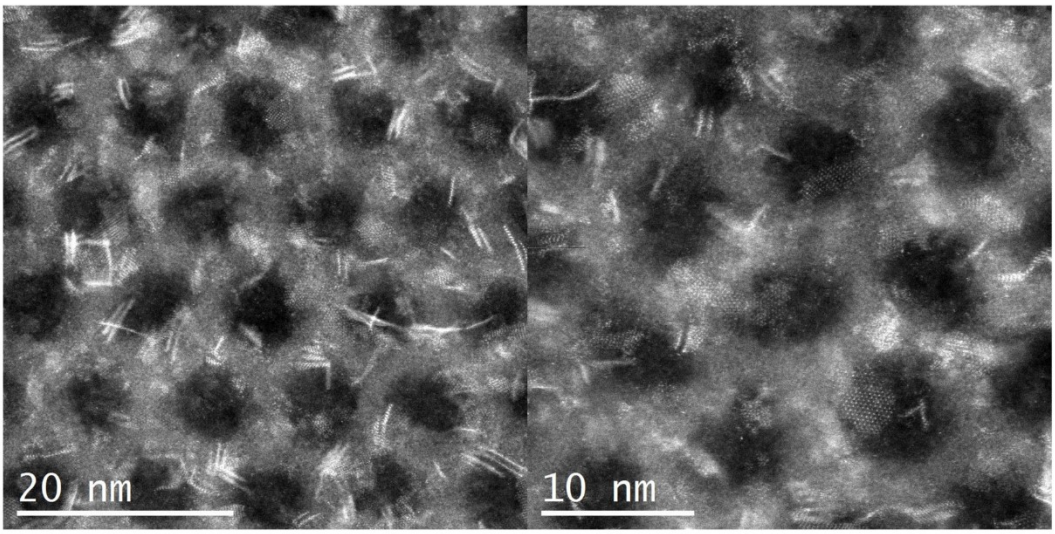

Figure S1. HAADF-STEM images of 2D/3D MoS_2@Ni/SBA-15

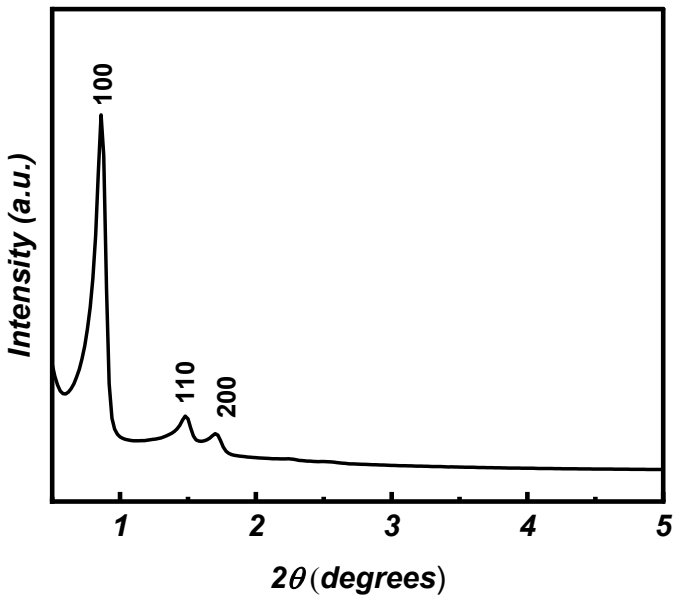

Figure S2. Low-angle XRD of SBA-15

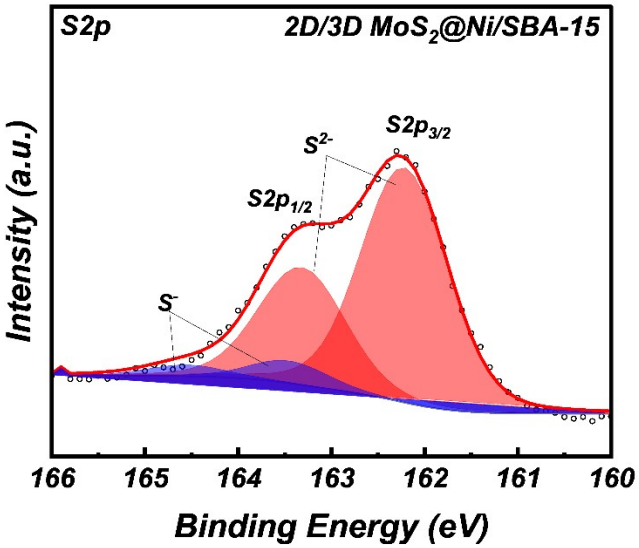

Figure S3. High-resolution spectra of the S 2p core level for 2D MoS_2@3D Ni/SBA-15 catalyst

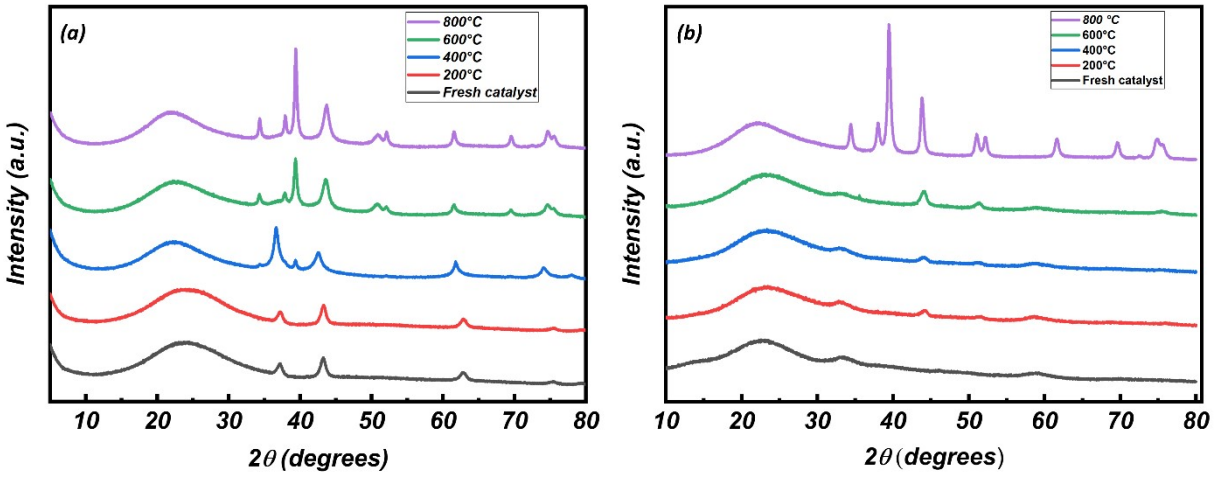

Figure S4. Ex situ X-ray diffraction (XRD) patterns of (a) MoO_3@NiO/SBA-15 and (b) 2D MoS_2@3D Ni/SBA-15 catalysts after RWGS reaction conducted at various temperatures (200, 400, 600°C) and after reaction at 800°C. The fresh catalysts are included for comparison. The evolution of diffractograms indicates the progressive transformation of MoO_3 and MoS_2 phases and the formation of MoC_x crystalline phase under reaction conditions.

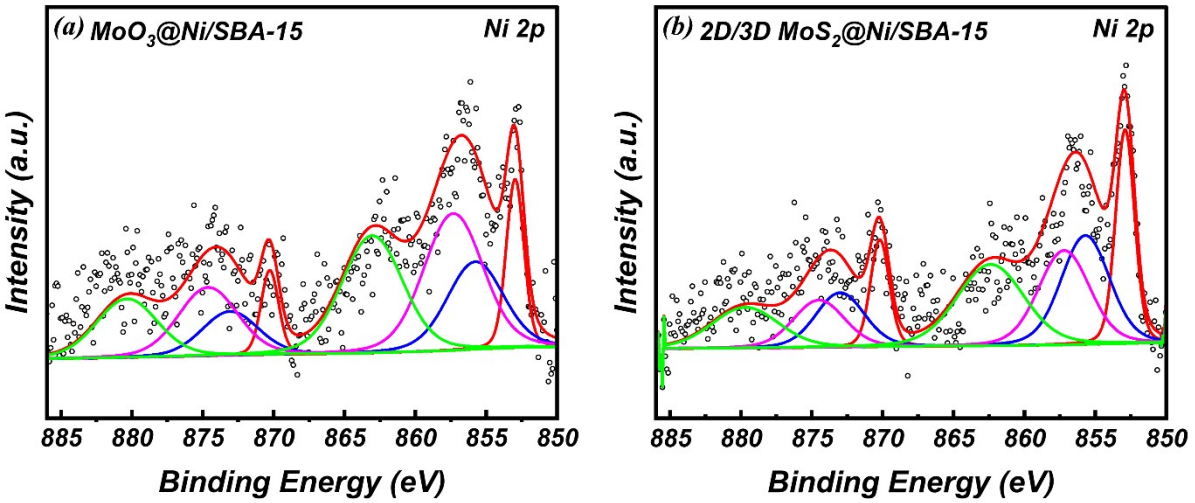

Figure S5. High-resolution Ni 2p XPS spectra of post-reaction (a) MoO_3@Ni/SBA-15 and (b) 2D/3D MoS_2@Ni/SBA-15 catalysts after RWGS operation.

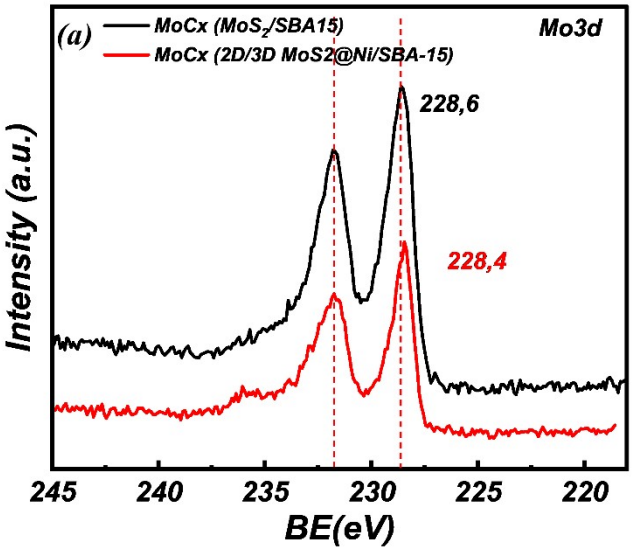

Figure S6. Mo 3d region for MoC_x phases obtained after the second catalytic run: comparison between Ni-free MoS_2/SBA-15 (black) and Ni-containing 2D/3D MoS_2@Ni/SBA-15 (red).

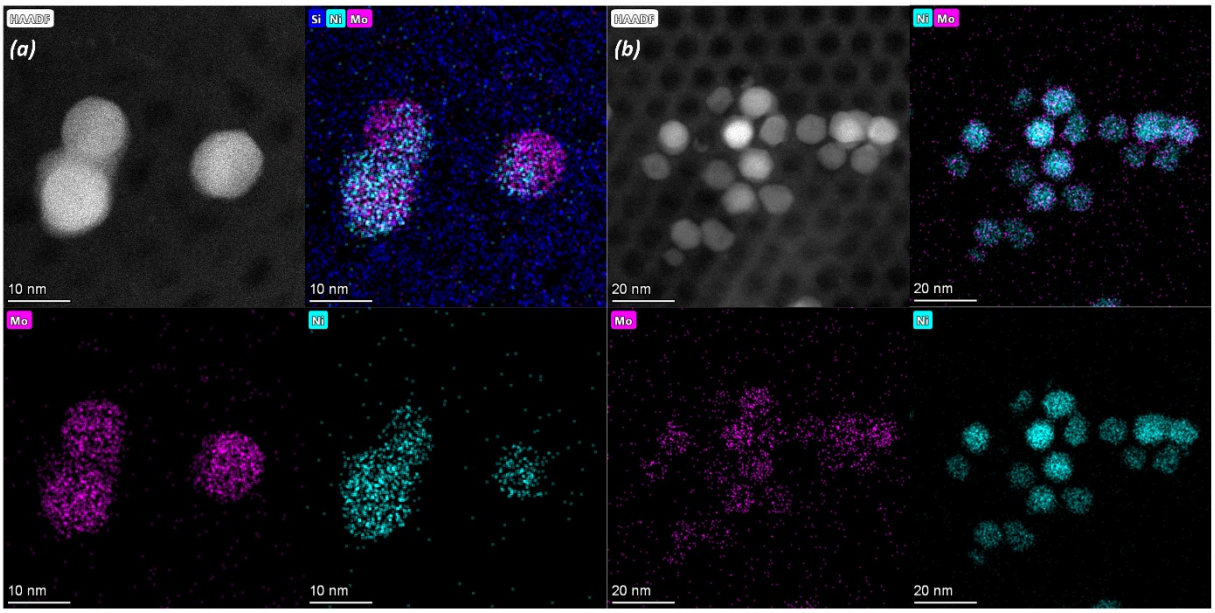

Figure S7. STEM-HAADF and EDS elemental mapping analysis of post-reaction (a) 2D/3D MoS_2@Ni/SBA-15 and (b) MoO_3@NiO/SBA-15 catalysts after 100 h of time-on-stream under RWGS conditions.

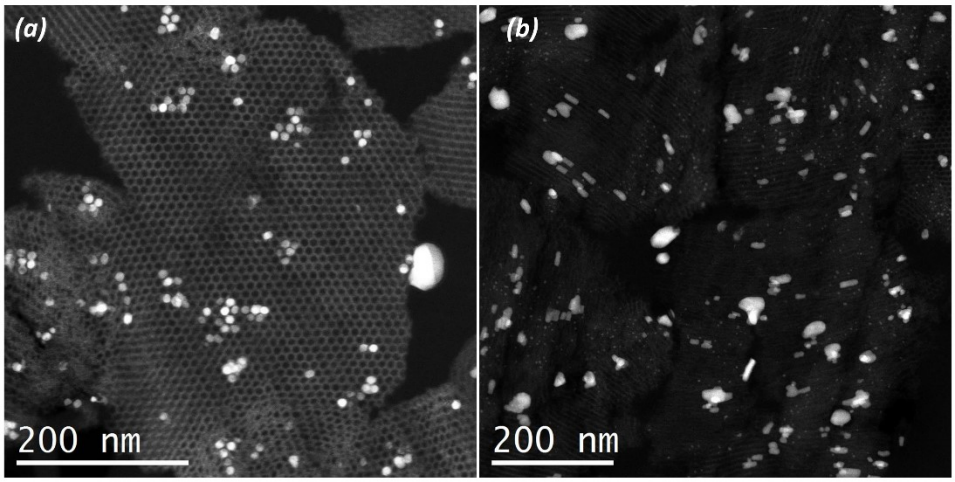

Figure S8. Lower-magnification HAADF-STEM images of post reaction (a) MoO_3@NiO/SBA-15 and (b) 2D/3D MoS_2@Ni/SBA-15 catalysts

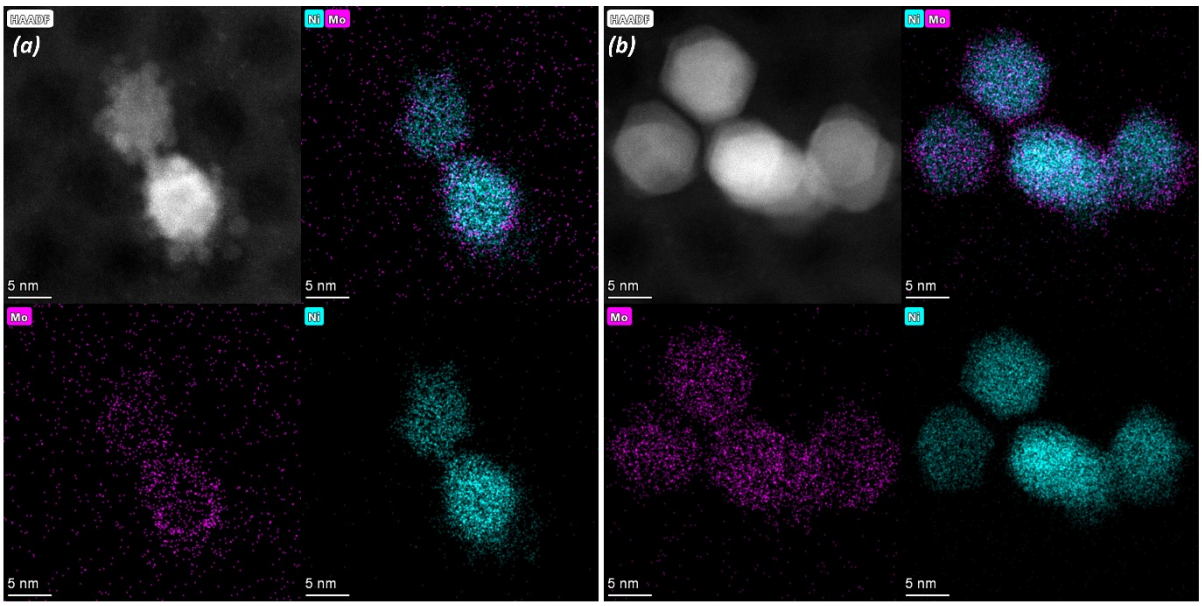

Figure S9. HAADF-STEM images and corresponding EDX elemental mappings of Mo and Ni for (a) fresh MoO_3@NiO/SBA-15 and (b) post-reaction MoO_3@NiO/SBA-15 catalysts.