Supporting information

Investigation of catalyst regeneration behavior in ethane dehydrogenation over Co@MFI catalysts

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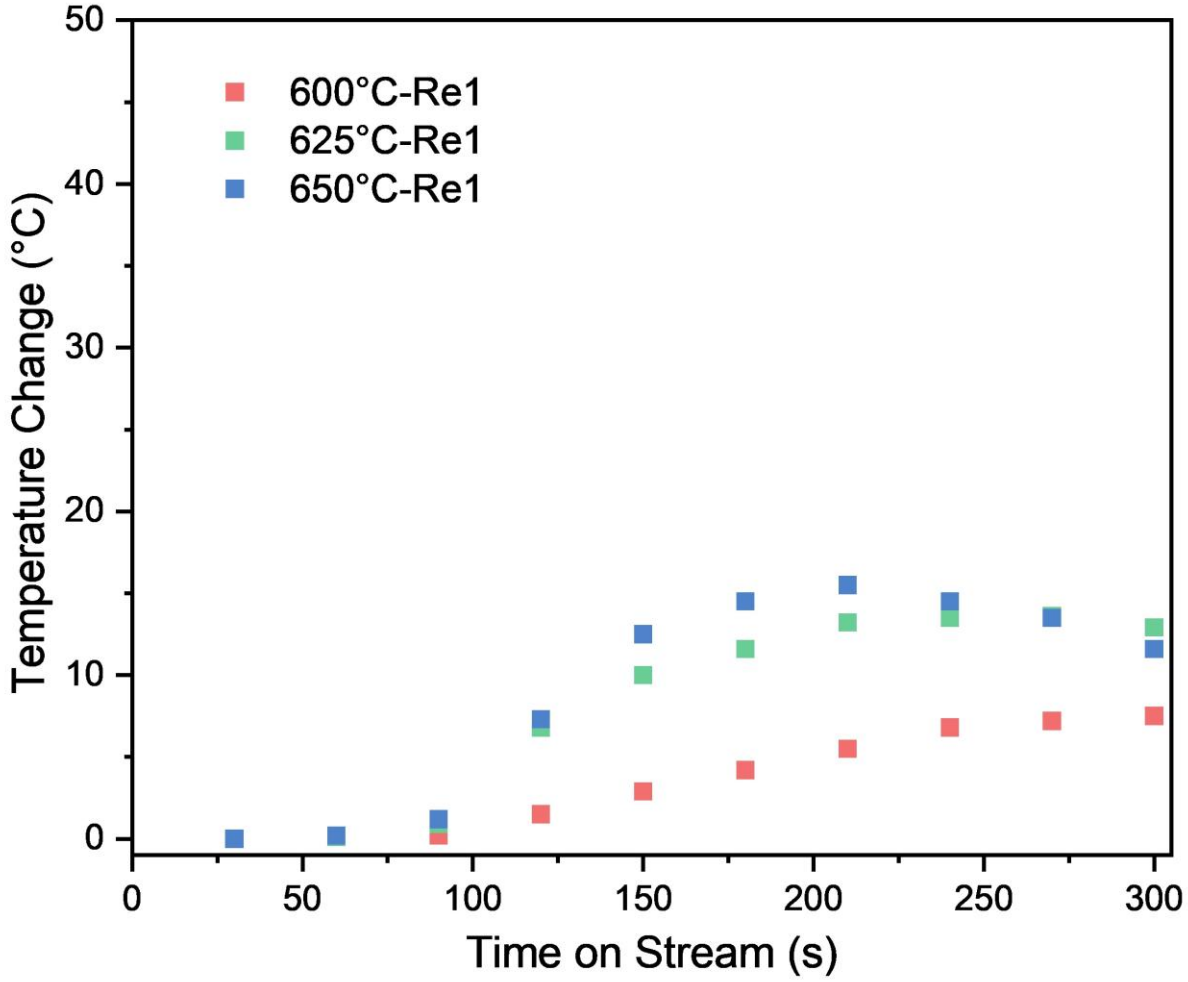

Fig S1. Bed temperature variation during regeneration at different temperatures for 6Co@MFI EDH. Reaction conditions: 0.3 g cat, WHSV = 6000 mL/g/h, 0.1 MPa, C_2H_6/N_2 = 9/1, reaction temperature 600 °C, regeneration temperatures 600/625/650 °C. Regeneration conditions: Under the same temperature and WHSV as reaction conditions, Ar purging for 5 min, followed by air regeneration for 5 min, then switched back to Ar purging for 5 min. One regeneration cycle is denoted as Re1.

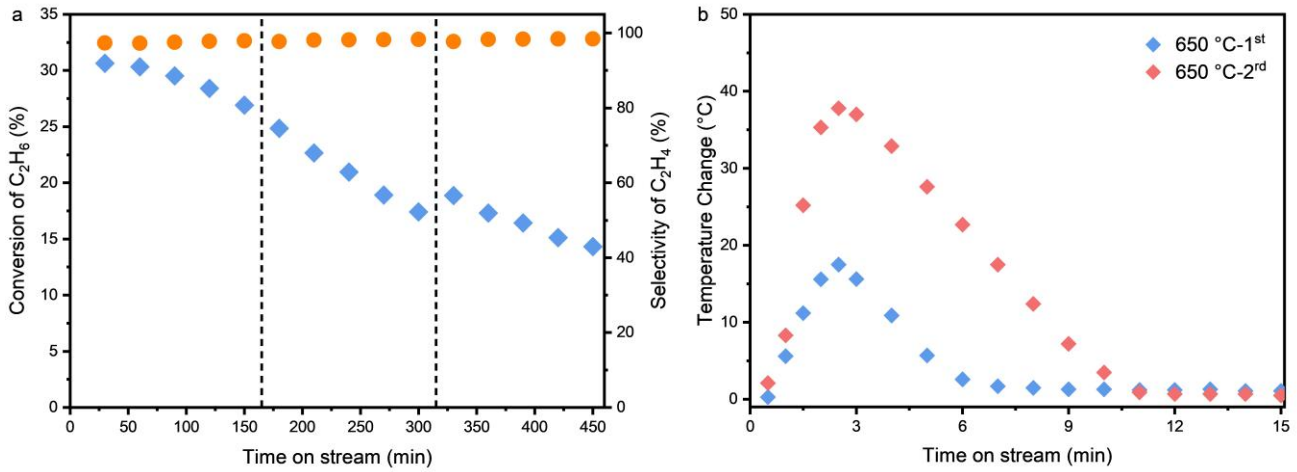

Fig S2. (a) Regeneration performance of the 6Co@MFI during ethane dehydrogenation at 650 °C and (b) temperature variation in the catalyst bed during two regeneration cycles. Reaction conditions: 0.3g cat, WHSV = 6000 mL/g/h, C_2H_6/N_2 = 9/1, with regeneration temperature of 650 °C. Regeneration conditions: At the same temperature and WHSV as the reaction conditions, Ar was introduced for 5 min, followed by air regeneration for 15 min, then switched back to Ar purging for 5 min. The temperature variation recorded corresponds to the air regeneration phase.

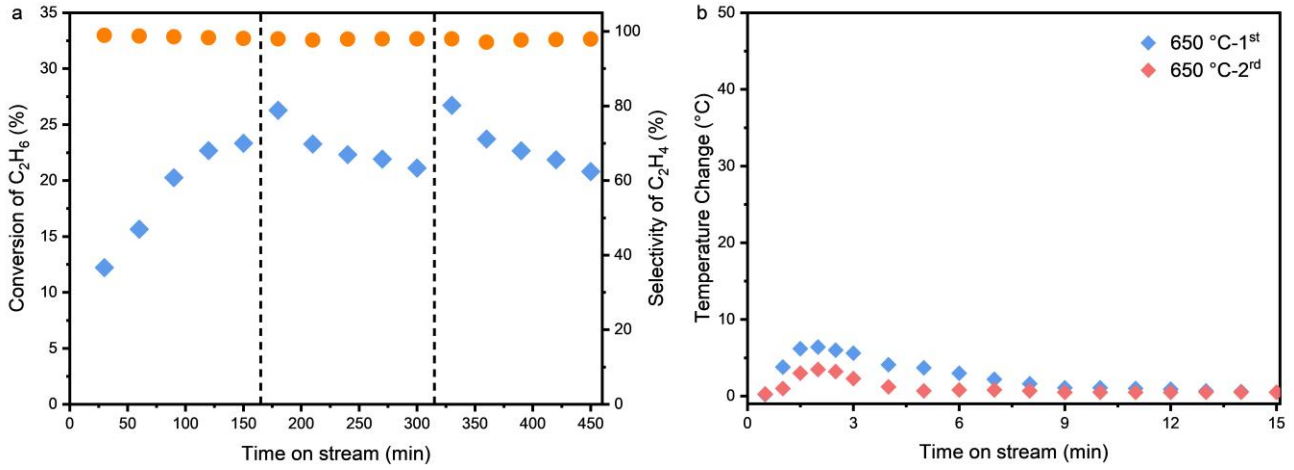

Fig S3. (a) Regeneration performance of the 6Co@MFI-aw during ethane dehydrogenation at 650 °C and (b) temperature variation in the catalyst bed during two regeneration cycles. Reaction conditions: 0.3 g cat, WHSV = 6000 mL/g/h, C_2H_6/N_2 = 9/1, with regeneration temperature of 650 °C. Regeneration conditions: At the same temperature and WHSV as the reaction conditions, Ar was introduced for 5 min, followed by air regeneration for 15 min, then switched back to Ar purging for 5 min. The temperature variation recorded corresponds to the air regeneration phase.

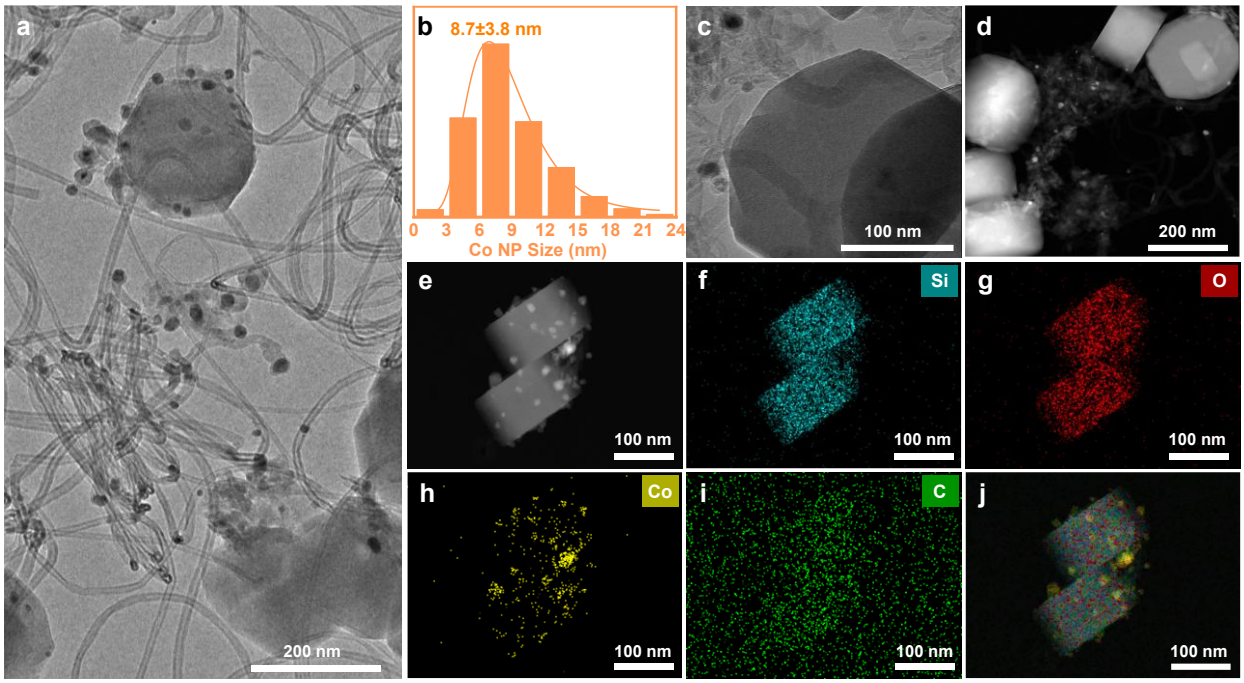

Fig S4. STEM images of 6Co@MFI after 7.5 h reaction at 600 °C, showing Co NPs size distribution and elemental mapping.

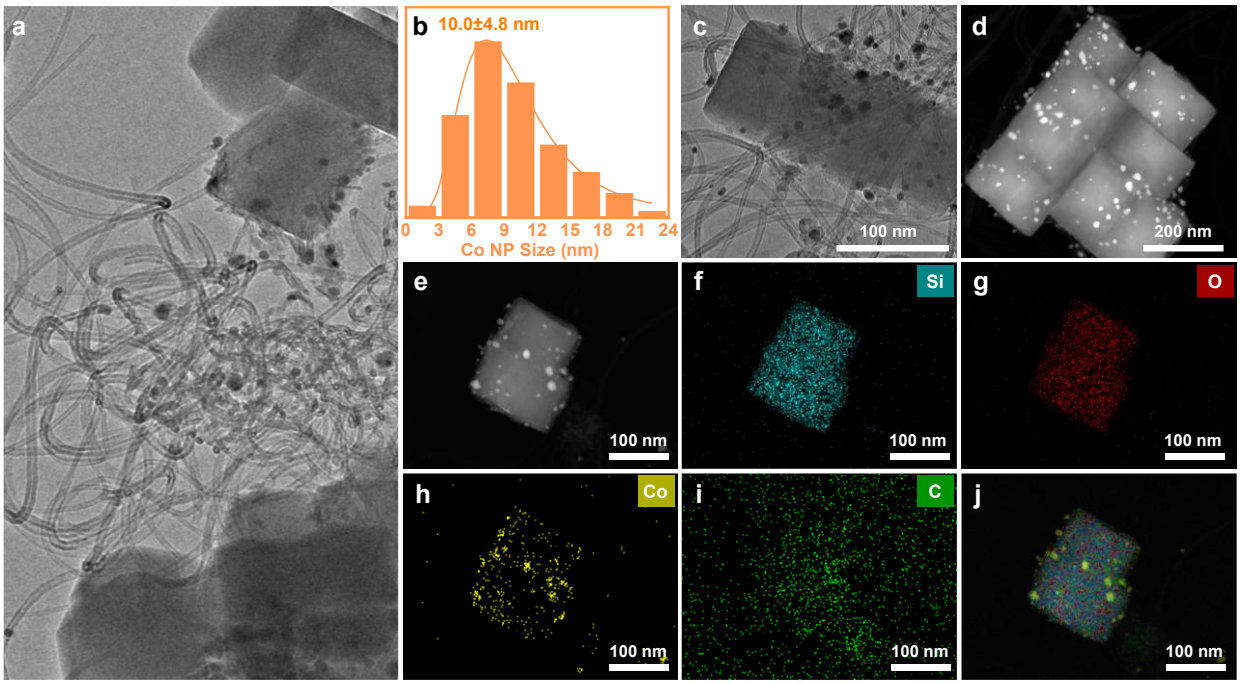

Fig S5. STEM images of 6Co@MFI after 7.5 h reaction at 625 °C, showing Co NPs size distribution and elemental mapping.

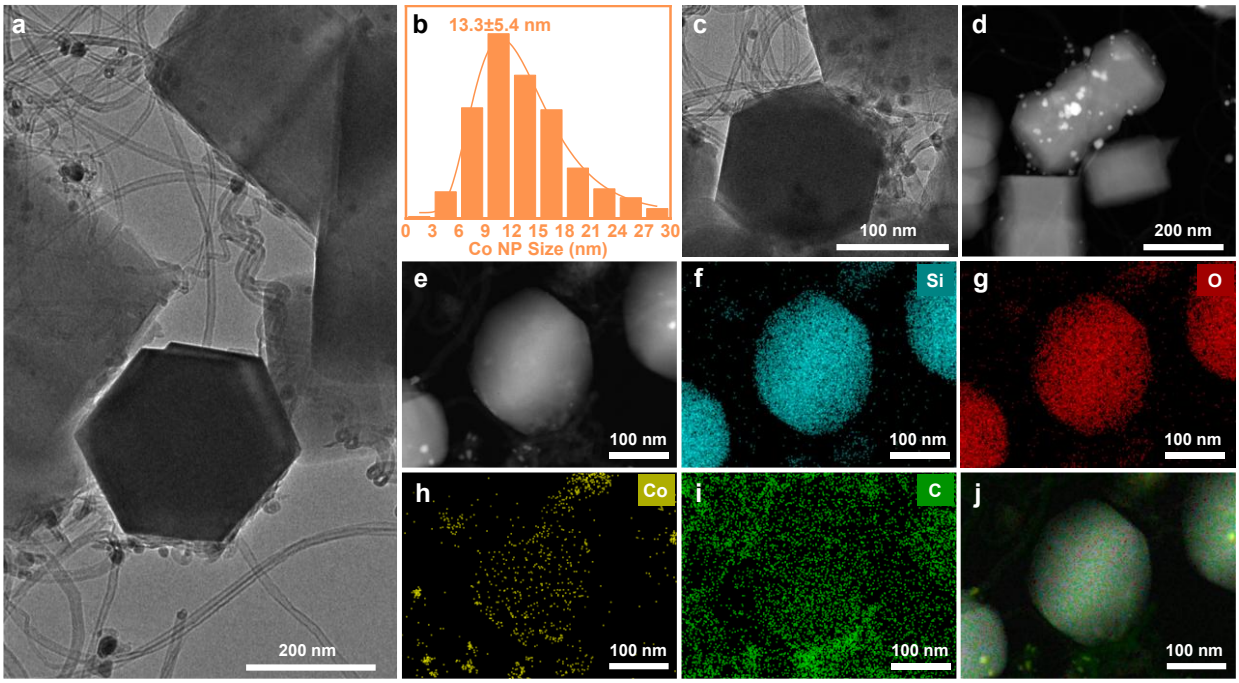

Fig S6. STEM image of 6Co@MFI after 7.5 h reaction at 650 °C, showing Co NPs size distribution and elemental mapping.

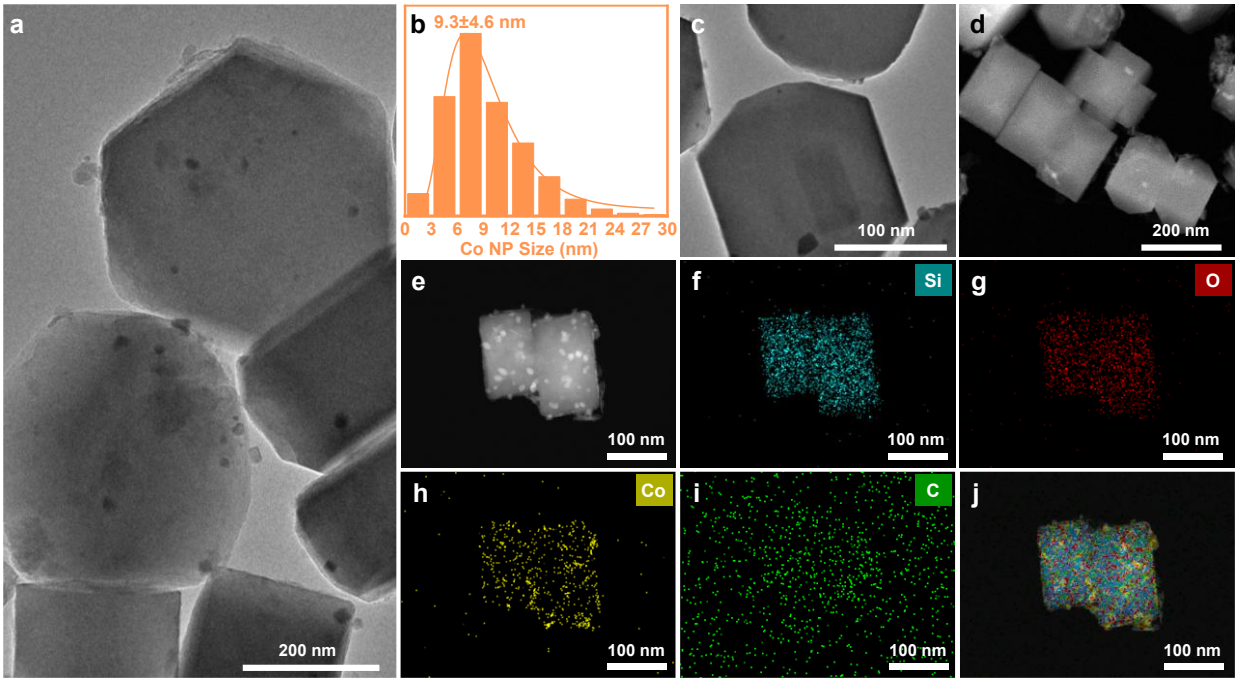

Fig S7. STEM images of 6Co@MFI after regeneration at 600 °C following 7.5 h reaction at 600 °C, showing Co NPs size distribution and elemental mapping.

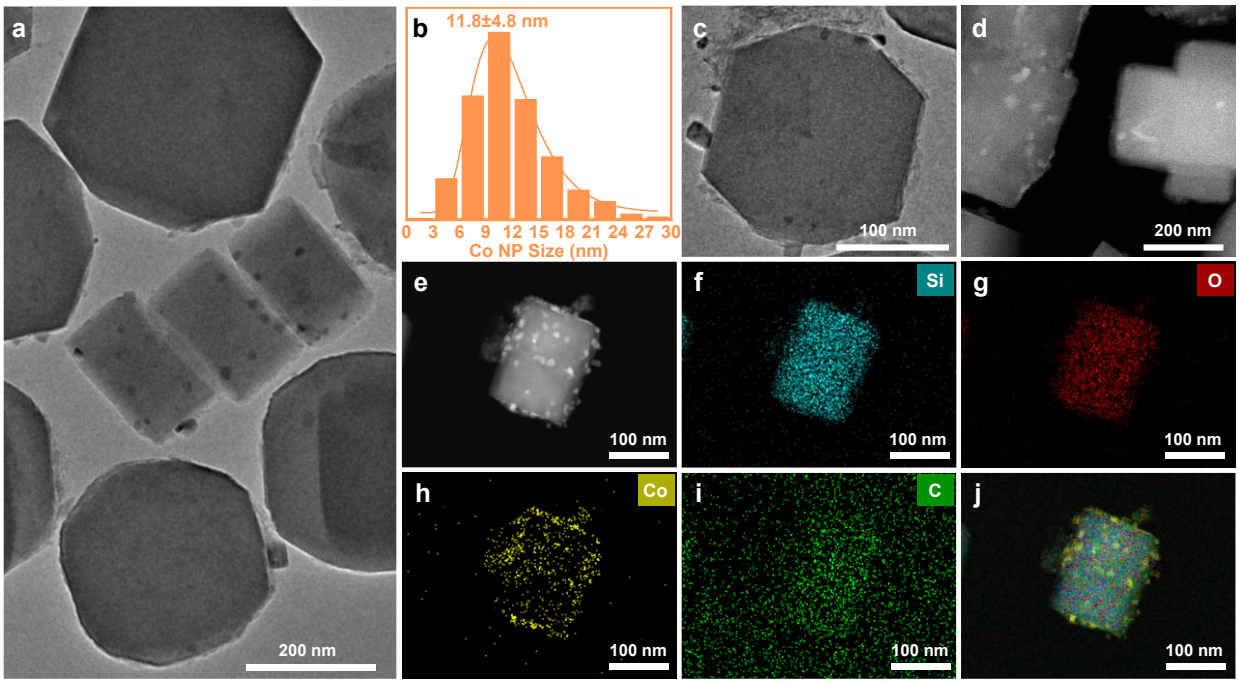

Fig S8. STEM images of 6Co@MFI after regeneration at 625 °C following 7.5 h reaction at 600 °C, showing Co NPs size distribution and elemental mapping.

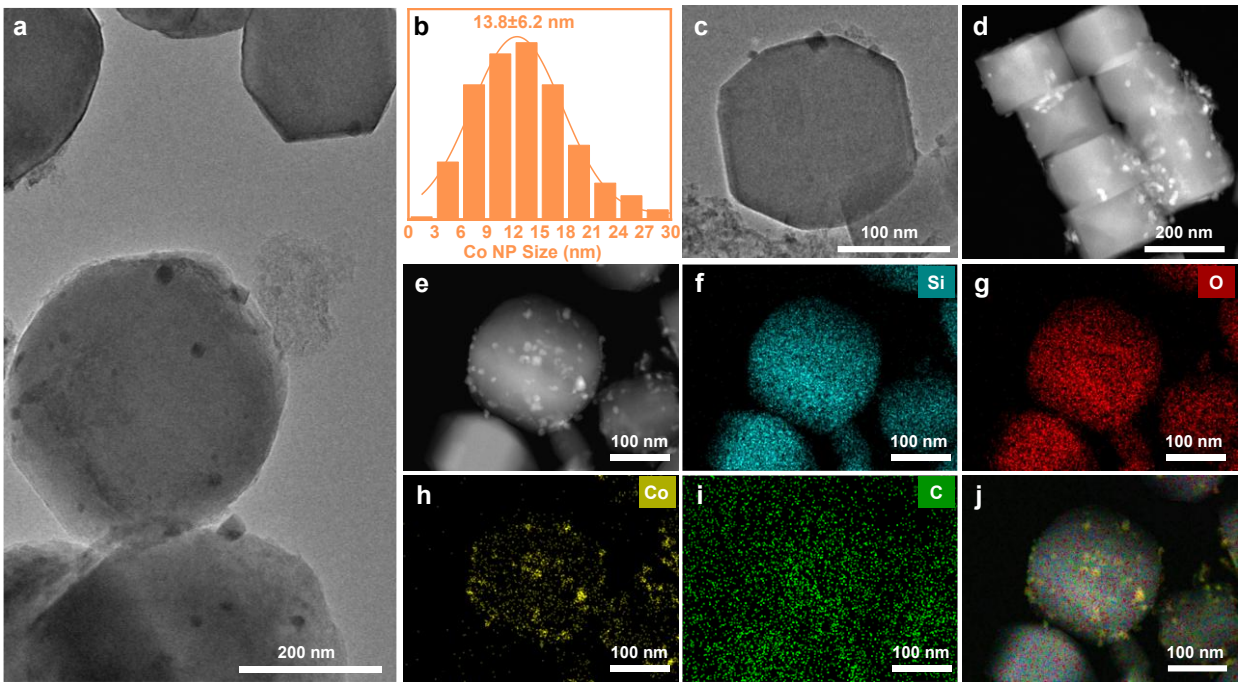

Fig S9. STEM images of 6Co@MFI after regeneration at 650 °C following 7.5 h reaction at 600 °C, showing Co NPs size distribution and elemental mapping.

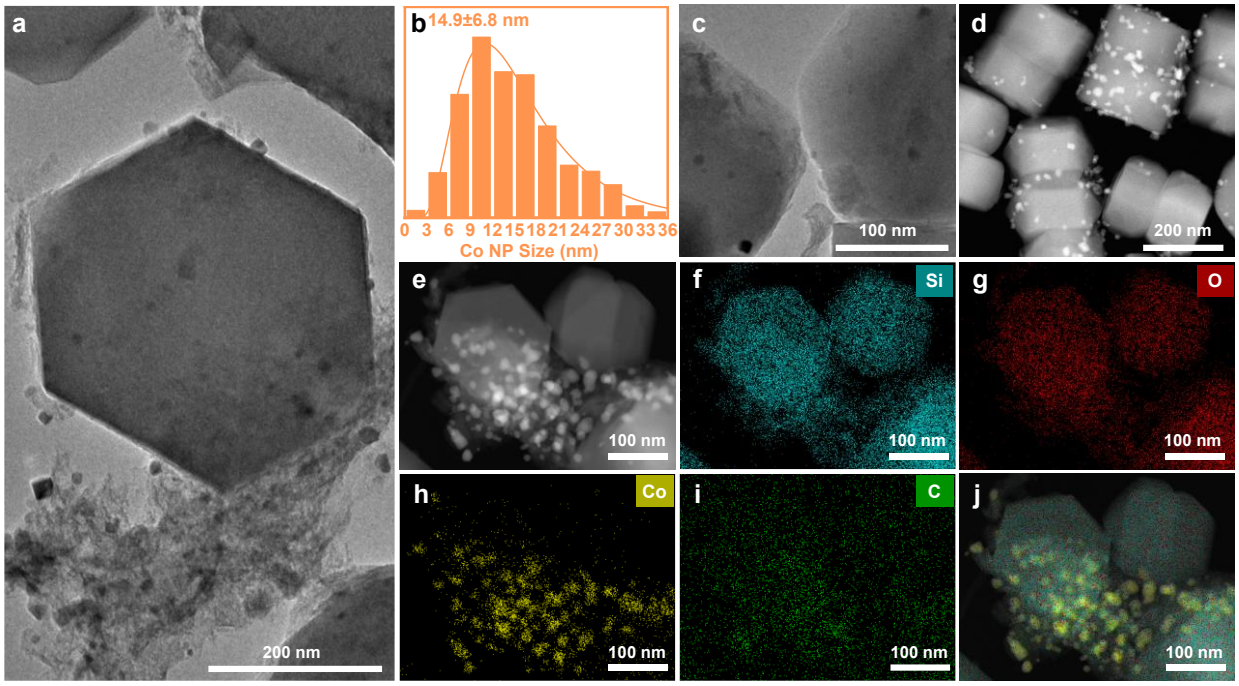

Fig S10. STEM images of 6Co@MFI after regeneration at 650 °C following 7.5 h reaction at 650 °C, showing Co NP size distribution and elemental mapping.

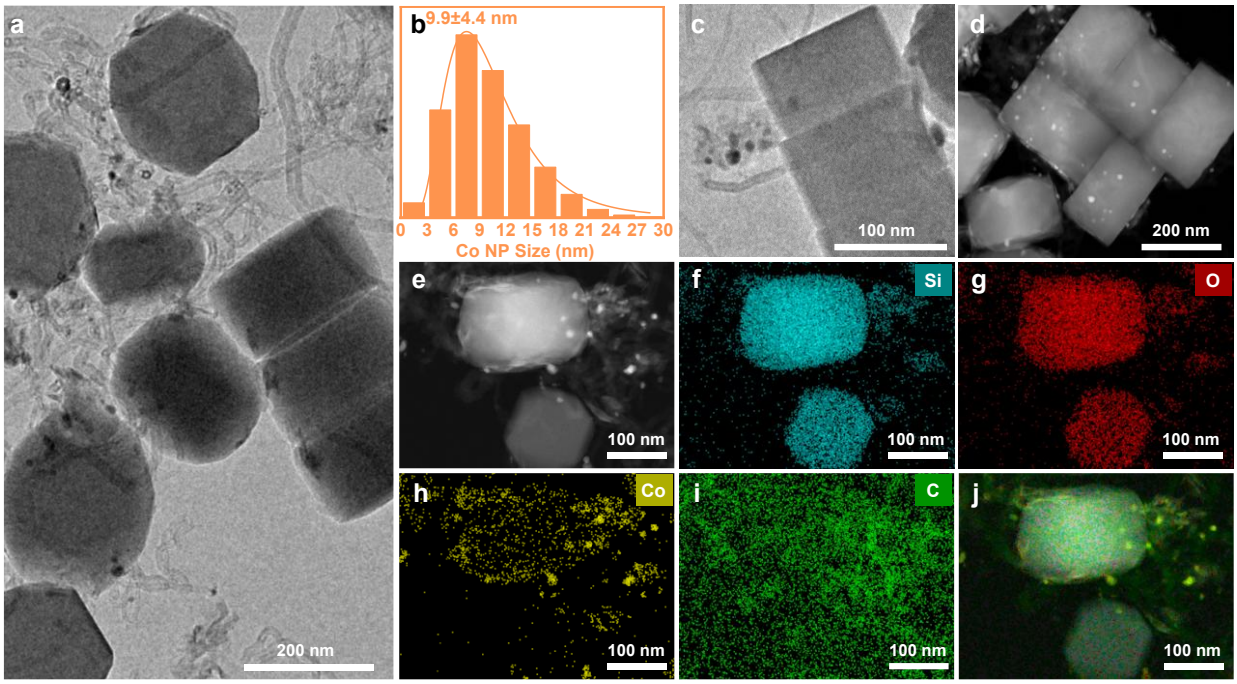

Fig S11. STEM image of Co NPs particle size distribution and elemental mapping after two regeneration cycles at 600 °C following 7.5 h reaction at 600 °C.

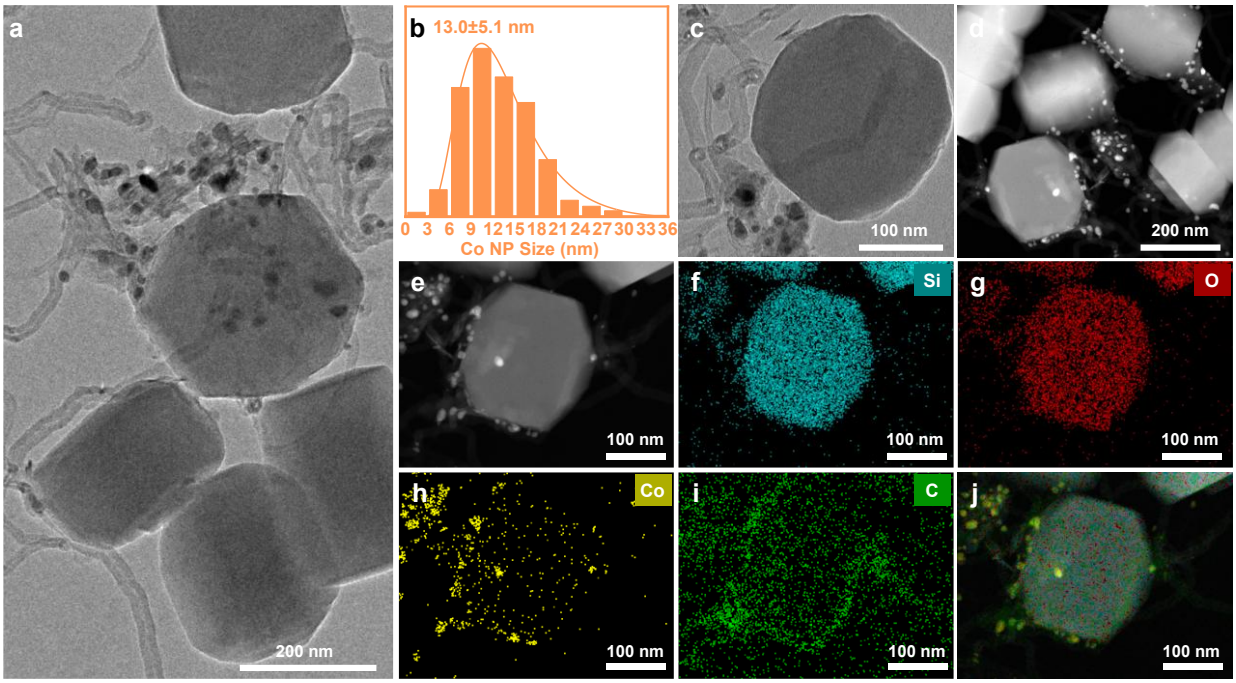

Fig S12. STEM images of Co NPs particle size distribution and elemental mapping after two regeneration cycles at 625 °C following 7.5 h reaction at 625 °C.

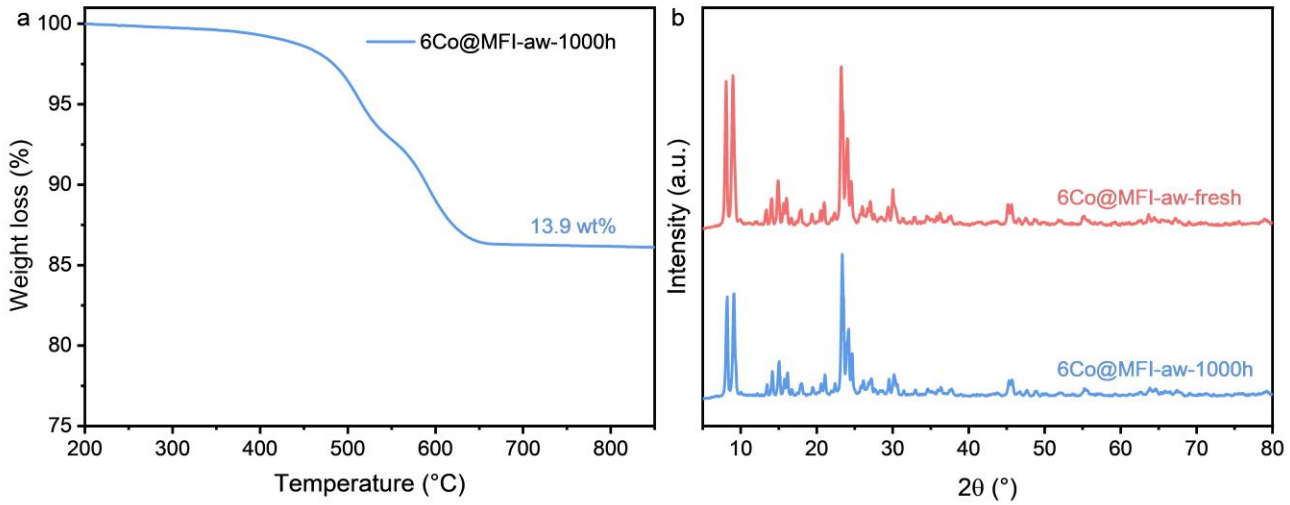

Fig. S13 (a) TGA and (b) XRD pattern of 6Co@MFI-aw after 1000 h of reaction.