

## **Supporting information:**

### **Hydrolytic dehydrogenation of ammonia borane over ZIF-67 derived Co nanoparticle catalysts**

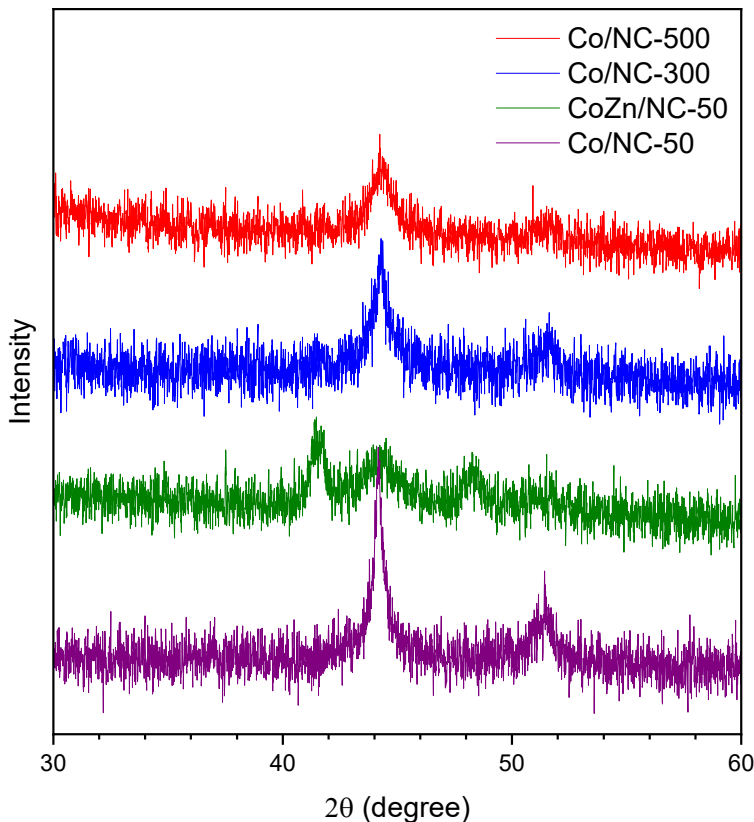
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## Characterization

### *Powder X-ray diffraction (XRD)*

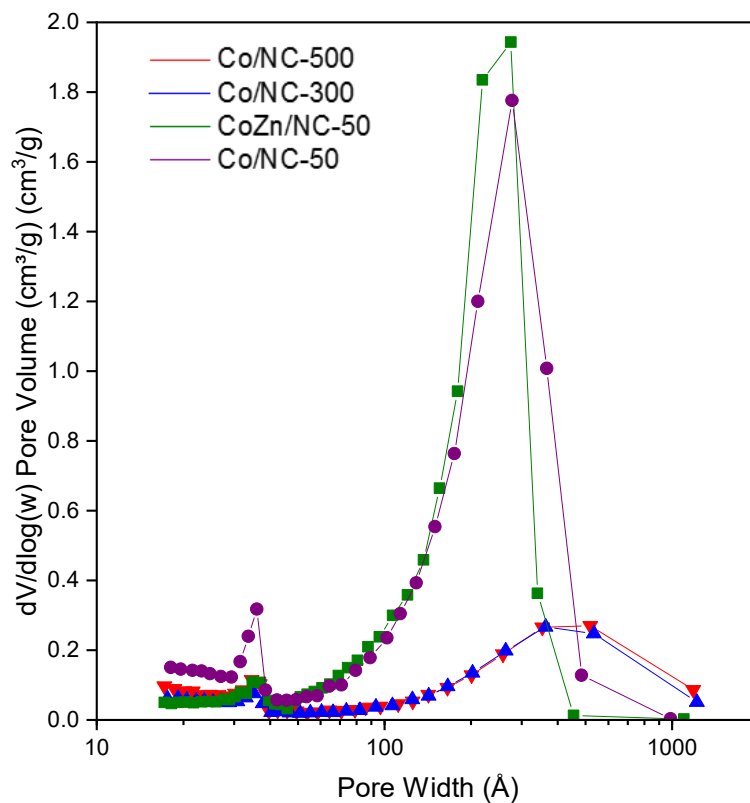
XRD of the catalyst precursors was measured in transmission mode using Cu-K $\alpha$  radiation from a focusing quartz monochromator and a HUBER G670 Guinier camera, recorded from 3-80°, 1h. XRD of the resulting catalysts were measured likewise but with a Stoe STADI P, recorded from 3-80°, 5h. All XRD data are presented as recorded without background correction.



**Figure S1.** XRD analysis of Co/NC-500, Co/NC-300, CoZn/NC-50 and Co/NC-50.

### *Nitrogen physisorption*

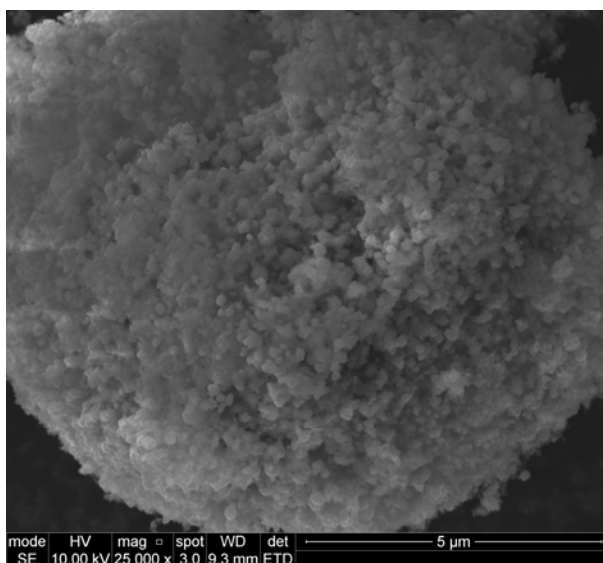
N<sub>2</sub> physisorption analysis was performed at 77 K on a Micromeritics 3Flex instrument. Prior to the analysis, the samples were outgassed in vacuum for 20 h at 200°C. The total surface area was calculated by the Brunauer-Emmett-Teller (BET) method, the micro-pore volume and external surface area were calculated by the t-plot method and the total pore volume was determined from the isotherm adsorption branch by a single point read at around  $p/p^0=0.95$ .



**Figure S2.** Pore size distributions of catalysts

*Scanning electron microscopy (SEM)*

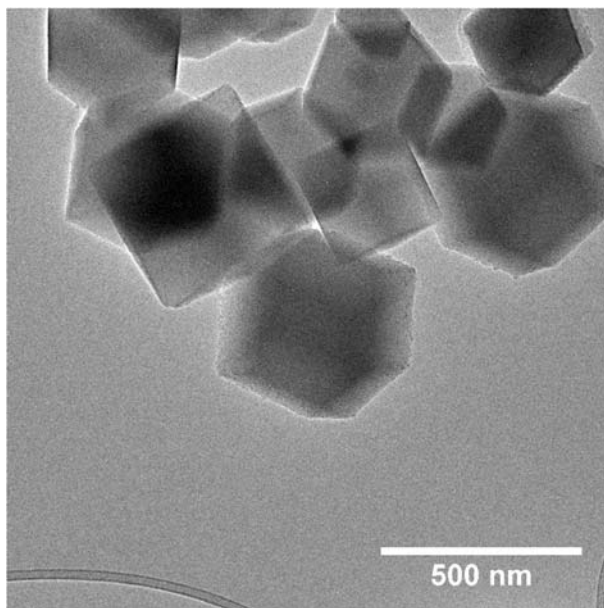
SEM was performed with a FEI Quanta 200 ESEM FEG operated at 10-20 kV. All samples were dispersed on carbon tape and coated with Au prior to analysis.



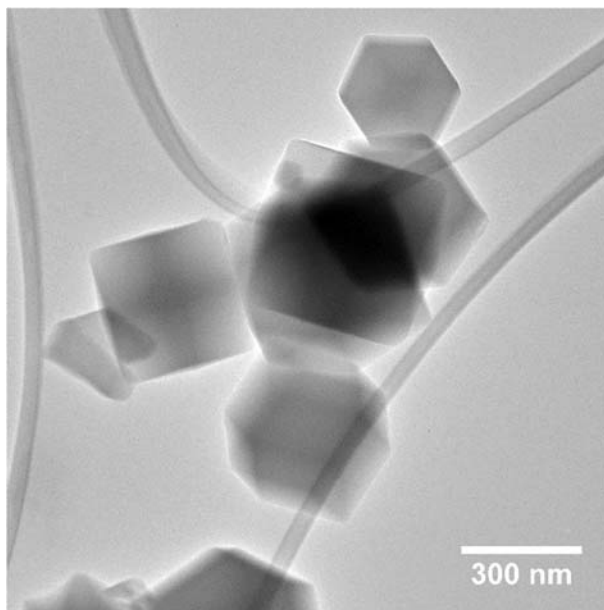
**Figure S3.** SEM analysis of Co/NC-50nm

*Transmission electron microscopy (TEM)*

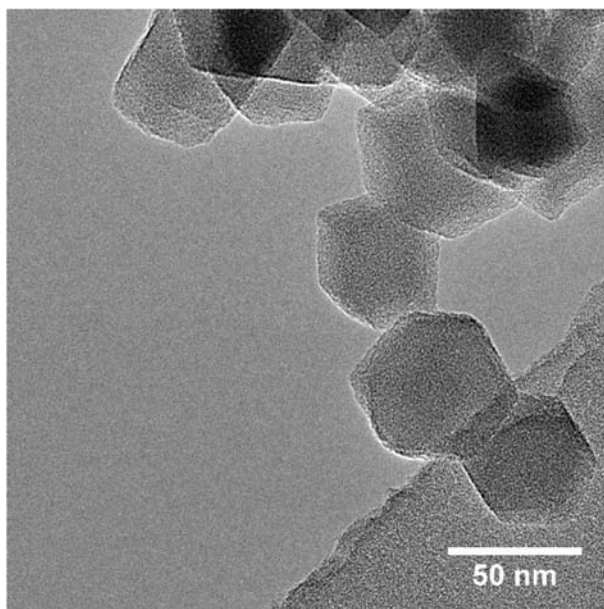
TEM analysis was performed with a FEI Tecnai microscope operated at 200kV. All samples were directly dispersed on holey or lacey carbon grids. Particle size distributions were estimated from measurements of >100 nanoparticles by TEM.



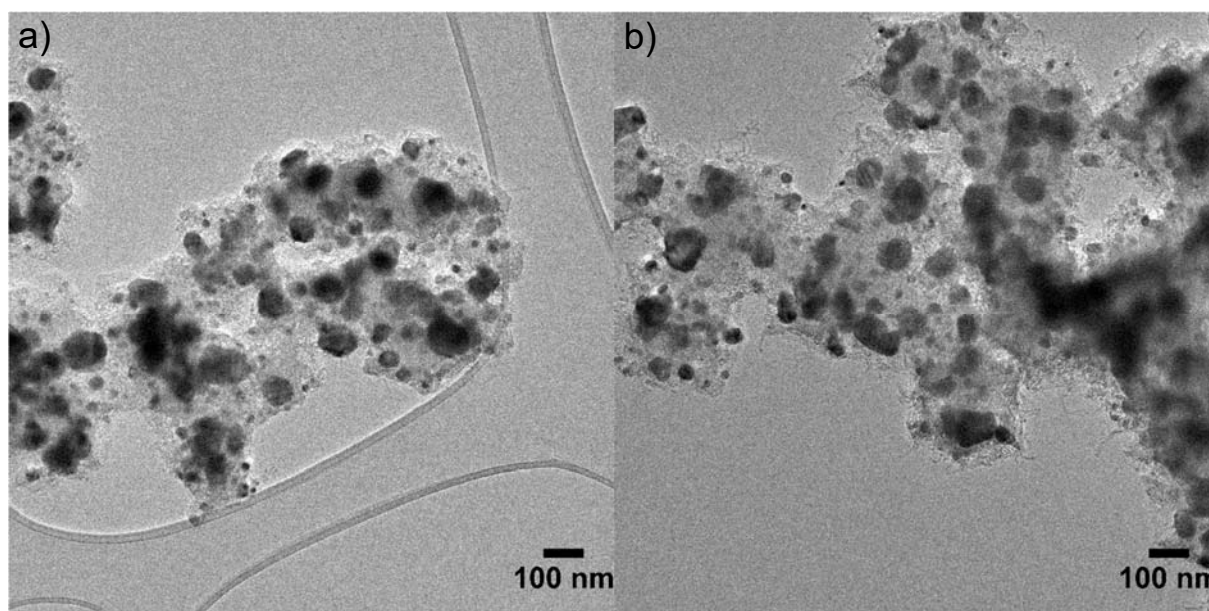
**Figure S4.** TEM image of ZIF-67-500



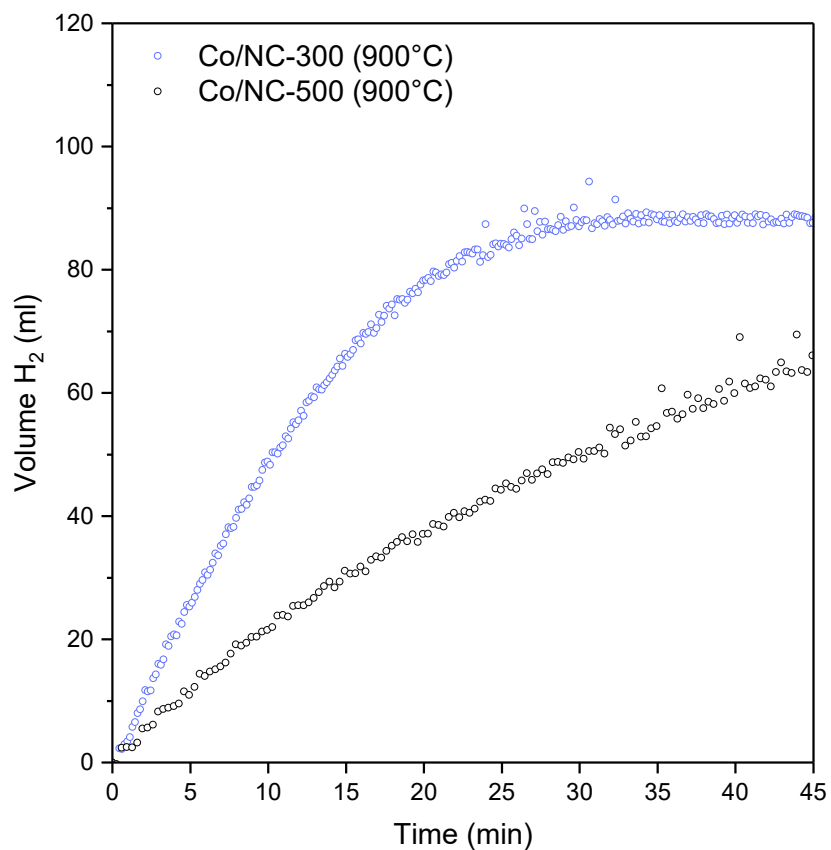
**Figure S5.** TEM image of ZIF-67-300



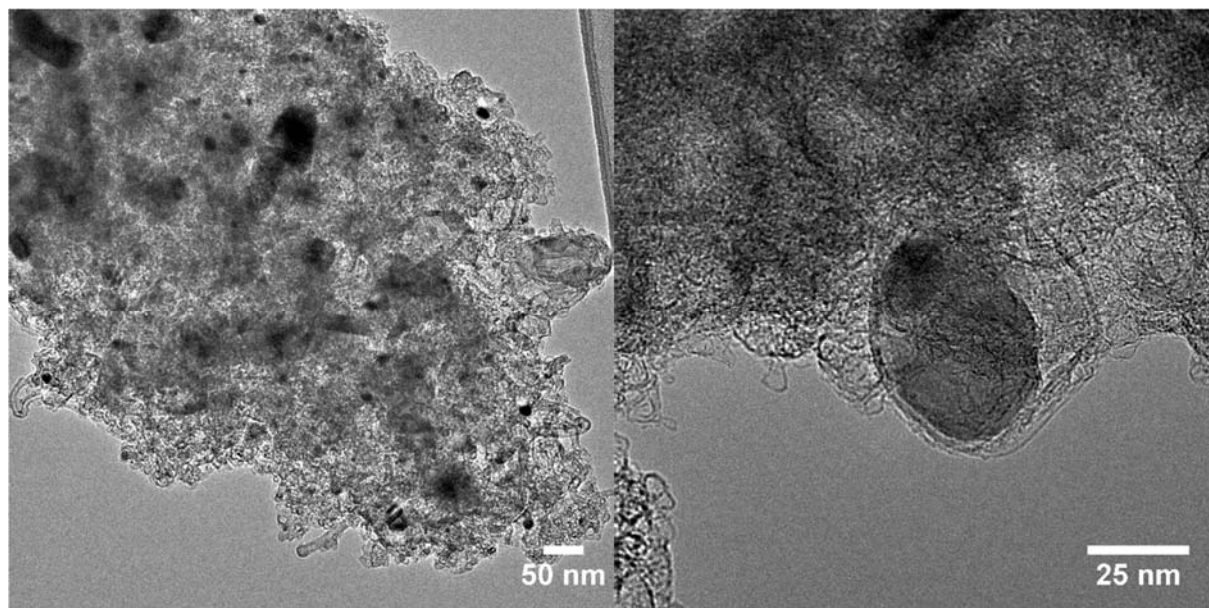
**Figure S6.** TEM image of ZIF-67/8-50



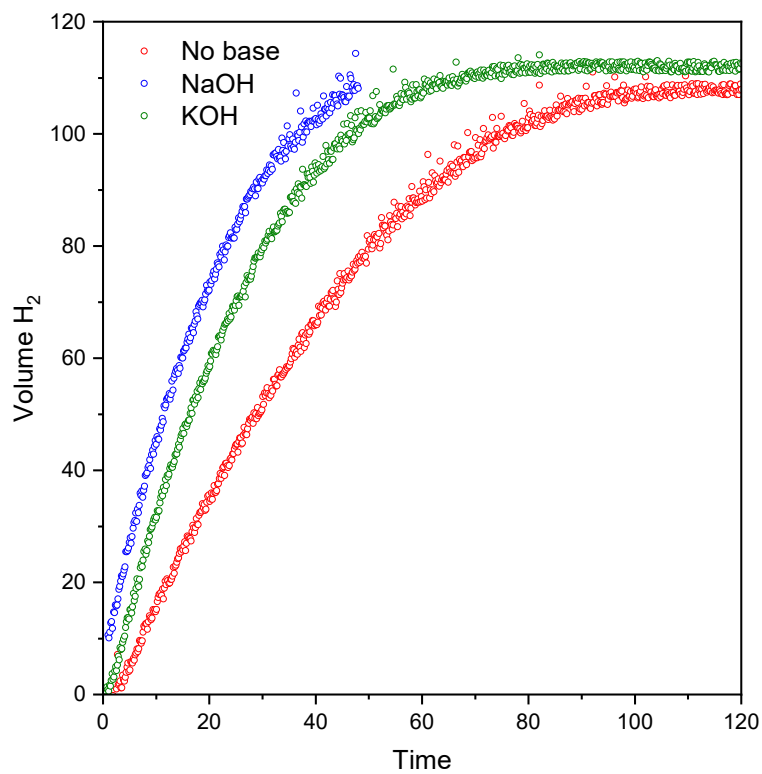
**Figure S7.** a) TEM images of reference materials ZIF-67-300 (900°C) and b) ZIF-67-500 (900°C) carbonized for 2h in Ar at 900°C.



**Figure S8.** Volume of released H<sub>2</sub> from the catalytic dehydrogenation of ammonia borane using 20 mg catalyst at 25°C with reference catalysts ZIF-67-500 (900°C) and ZIF-67-300 (900°C) carbonized for 2h in Ar at 900°C.



**Figure S9.** TEM images of recycled Co/NC-50.



**Figure S10.** Volume of released H<sub>2</sub> from the catalytic dehydrogenation of ammonia borane using 10 mg of catalyst at 25°C with the addition of 0.1 M NaOH and KOH.