Supporting Information

Carbon formation mechanism of C_2H_2 in Ni based catalysts revealed by *in situ* electron microscopy and molecular dynamics simulations

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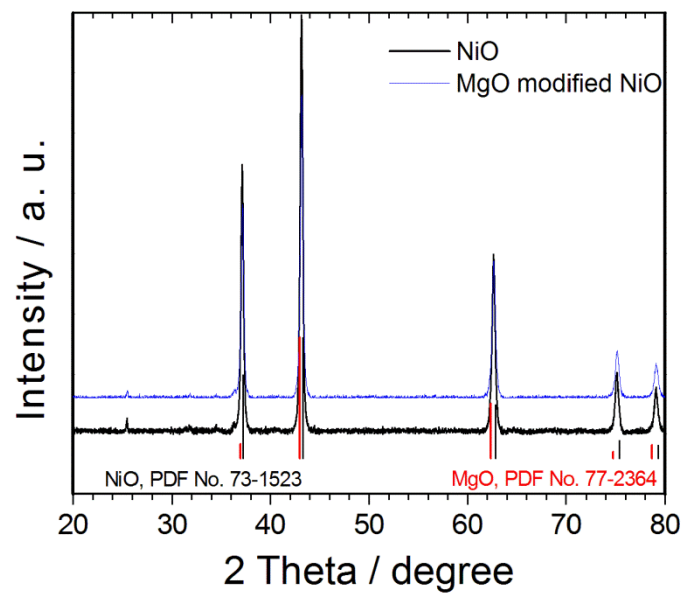E-mail: sunchunwen@binn.cas.cn (C. Sun); jian.chen@nrc-cnrc.gc.ca (J. Chen) and pguan@csrc.ac.cn (P. Guan)

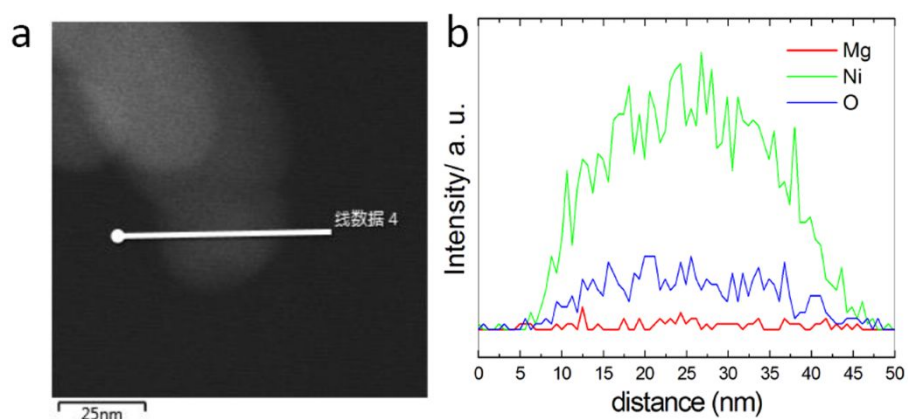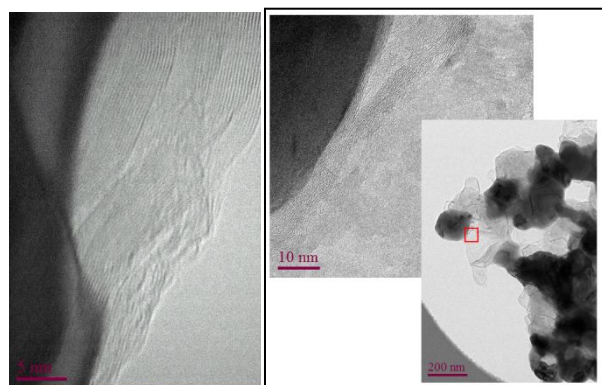**Figure S1.** XRD patterns of NiO and MgO modified NiO samples.

Figure S2. (a) ADF STEM image of MgO modified NiO particle and (b) The line scanning profiles of elements across the particle in (a).

(a) (b)

Figure S3. (a) TEM image showing graphitic layers formed in NiO sample at 800ºC under $H_2+C_2H_2$. Electron energy loss spectrum (EELS) confirms it is carbon. (b) TEM image showing graphic layers formed in MgO modified NiO sample at 800ºC under $H_2+C_2H_2$. The upper left image is the HRTEM of the region marked by the red square in the low magnification image.