
Structural evolution of iron nanoparticles involving the formation and growth of iron carbide nuclei in the iron nanoparticle was directly visualized at the atomic level, using environmental transmission electron microscopy (TEM) under reactive conditions mimicking Fischer–Tropsch synthesis. Formation of the iron carbide nuclei and surface reconstruction of the iron nanoparticle play an essential role in carburization of the iron nanoparticle and consequent formation of Fe5C2. Identification of carbide and oxide intermediates evidenced by high-resolution TEM images, electron diffraction patterns and electron energy-loss spectra provides a detailed picture from initial activation to final degradation of iron under synthesis gas.

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