Intermetallic compounds of Ni and Ga as catalysts for the synthesis of methanol - DTU Orbit (14/10/2019)

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In this work, we present a detailed study of the formation of supported intermetallic Ni–Ga catalysts for CO₂ hydrogenation to methanol. The bimetallic phase is formed during a temperature-programmed reduction of the metal nitrates. By utilizing a combination of characterization techniques, in particular in situ and ex situ X-ray diffraction, in situ X-ray absorption spectroscopy, transmission electron microscopy combined with electron energy loss spectroscopy and X-ray fluorescence, we have studied the formation of intermetallic Ni–Ga catalysts of two compositions: NiGa and Ni₅Ga₃. These methods demonstrate that the catalysts with the desired intermetallic phase and composition are formed upon reduction in hydrogen and enable us to propose a mechanism of the Ni–Ga nanoparticles formation. By studying the effect of calcination prior to catalyst reduction, we show that the reactivity depends on particle size, which suggests that the reaction is structure sensitive.

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