Coarsening of carbon black supported Pt nanoparticles in hydrogen

This study addresses coarsening mechanisms of Pt nanoparticles supported on carbon black in hydrogen. By means of in situ transmission electron microscopy (TEM), Pt nanoparticle coarsening was monitored in 6 mbar 20 % H2/Ar while ramping up the temperature to almost 1000 °C. Time-resolved TEM images directly reveal that separated ca. 3 nm sized Pt nanoparticles in a hydrogen environment are stable up to ca. 800 °C at a heating rate of 10 °C/min. The coarsening above this temperature is dominated by the particle migration and coalescence mechanism. However, for agglomerated Pt nanoparticles, coalescence events were observed already above 200 °C. The temperature-dependency of particle sizes and the observed migration distances are described and found to be consistent with simple early models for the migration and coalescence.

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