FLUIDIZATION OF GRAPHENE NANOPLATELETS FOR ATOMIC LAYER DEPOSITION

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Graphene is an ideal catalysis support: it has a high surface area, is chemically and thermodynamically inert, and has high carrier mobility. A special type of graphene nanoparticles are graphene nanoplatelets. They consist of small stacks of graphene giving them a thickness of 1 – 15 nm while their diameters can range up to a few micrometres. However, for catalysis these nanoplatelets have to be provided with catalyst materials such as platinum or titania. One very promising technique for such a modification is Atomic Layer Deposition of nanoparticles on the graphene, which can provide a fast, highly controlled and scalable process.
However, to separate the carbon nanoplatelets and achieve free large accessible surfaces in the reactor nanoplatelets have to be fluidized. While fluidization of carbon nanotubes is already well established, fluidization of nanoplatelets is a completely new research topic and was, to the best of our knowledge, not investigated so far. Based on the size of the carbon nanoplatelets they are treated as very cohesive (Geldart group C) powders which are hard to fluidize. Nevertheless, homogenous fluidization could be achieved by using assistance methods such as mechanical vibration.

Here we present a detailed analysis of the fluidization behaviour of carbon nanoplatelets for atomic layer deposition. We analysed the bed expansion behaviour of the nanoplatelets depending on the gas velocities. Since the Atomic Layer Deposition process can be run at different temperatures, depending on the used precursors, we further analysed the influence of the temperature on the fluidization behaviour. Finally, we investigated the reproducibility of our results by an statistical analysis of our results.

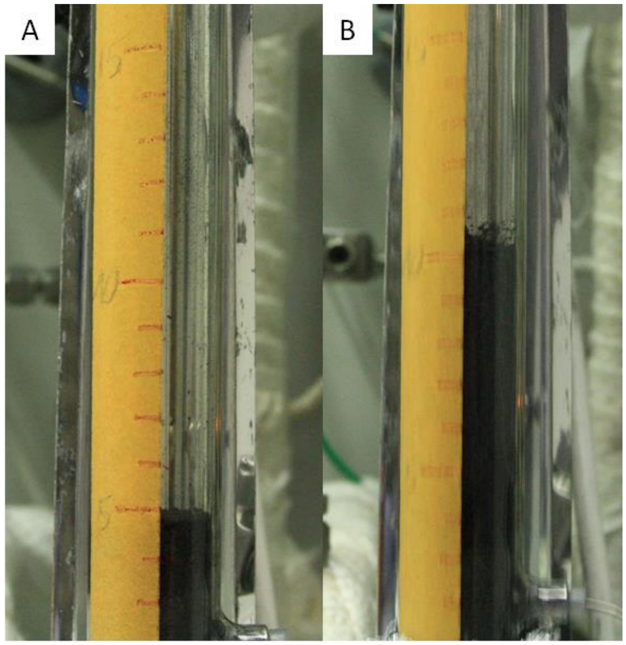

Figure 1: Fluidization of carbon nanoplatelets. A) before fluidization and B) during fluidization.

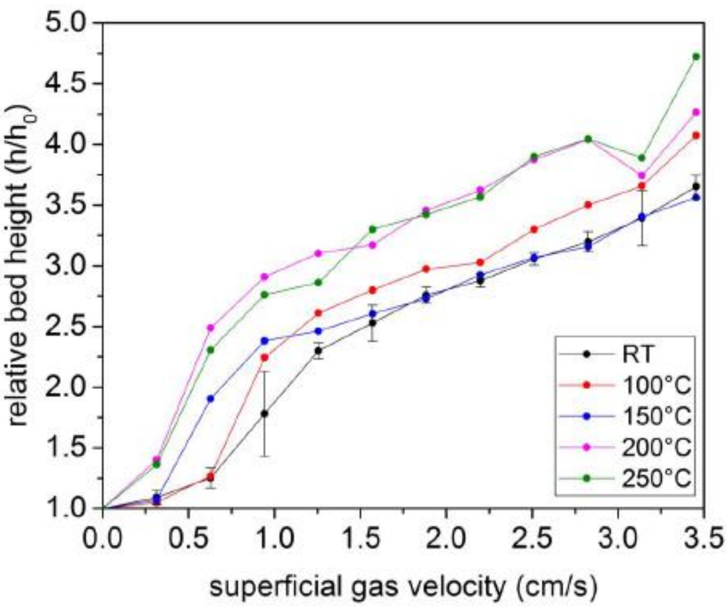

Figure 2: Fluidization of carbon nanoplatelets at different gas velocities and temperatures. Higher temperatures enhance the fluidization of the nanoplatelets.