Supplementary Information

Strategies to initiate and control the nucleation behavior of bimetallic nanoparticles

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A. Target configuration

Figure 1. Showing the different types of section target arrangement used for the production of nanoparticles.

B. Nanoparticle deposition source

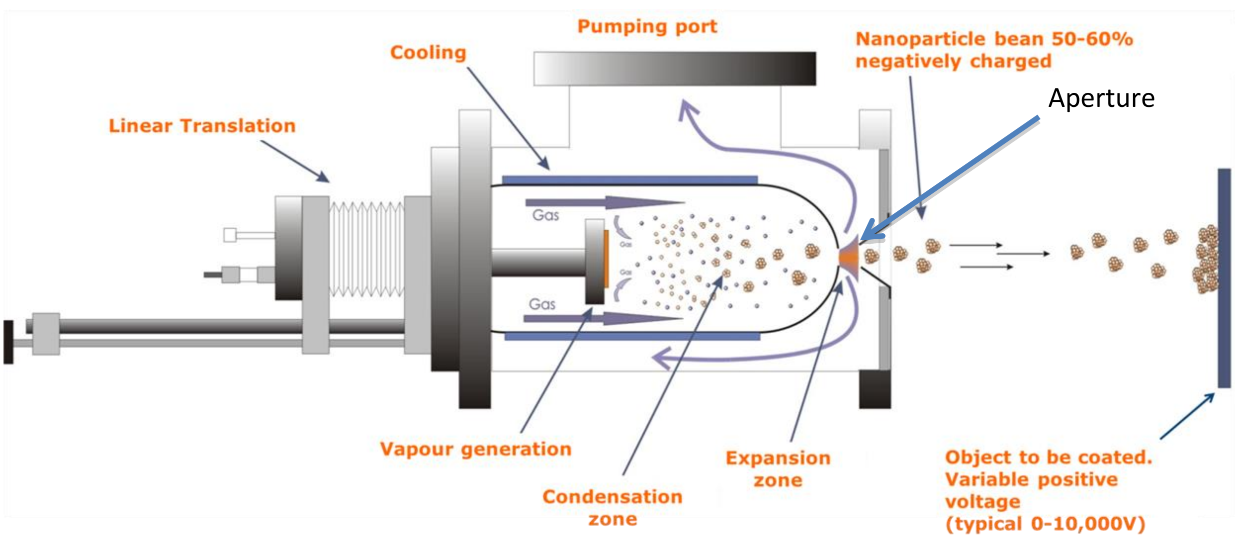

Figure 2. Schematic of the nanoparticle production set up (Mantis deposition Ltd).

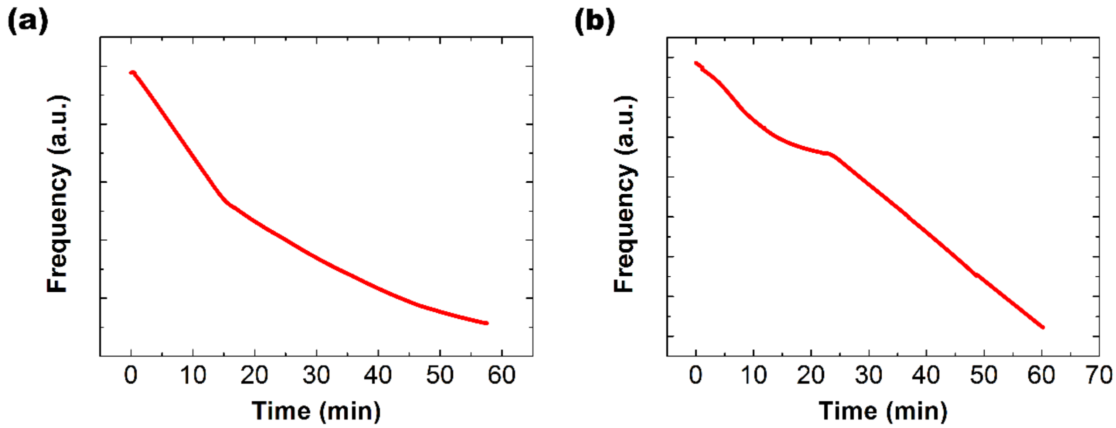

Figure 3. Showing a QCM (Quartz Crystal Microbalance) frequency as a function of MgTi sputtering time. (a) After 15 minutes of MgTi sputtering a sudden change/drop in nucleation yield (mass flux) is observed which eventually drops to zero, this behaviour indicates a change in nucleation and growth conditions. (b) After 20 minutes of MgTi sputtering and once nanoparticle yield/ mass flux decays to zero, methane was introduced which stabilize the mass flux as indicated by straight line for the remaining deposition time until methane was introduced.

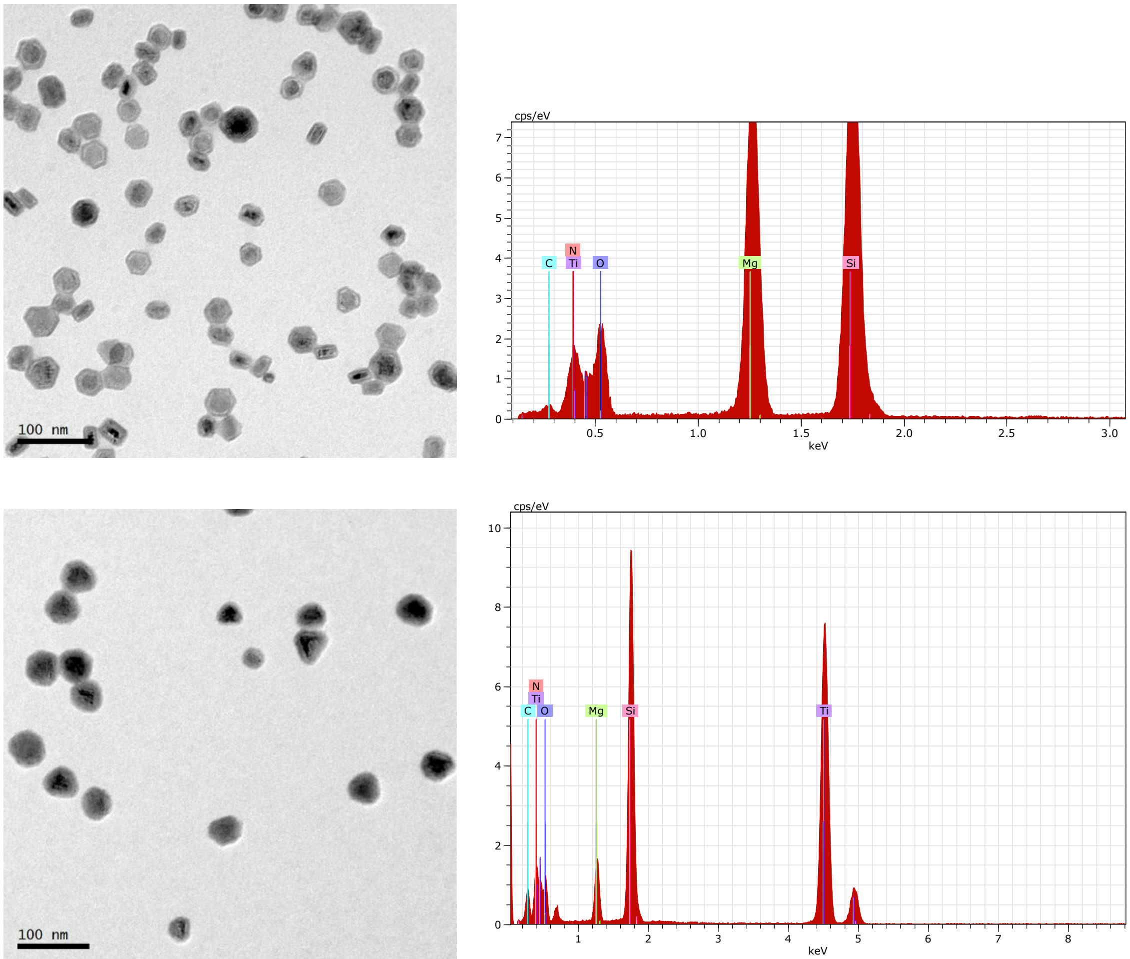

Figure 4.NPs with their corresponding high resolution EDX spectra, which were measured by focussing the electron beam on a NP core. When synthesised with hydrogen gas (top), the composition of the core is 55 at% Mg, 38 at% Ti and 7 at% C. Due to local probing the amount of Ti and C is most relevant, which yields 84 at% Ti and 16 at% C. The small amount of carbon is most likely the result of contamination during storage and transfer to the TEM. In the case when methane gas is used, the composition of the core is 9 at% Mg, 60 at% Ti and 31 at% C. The amount of Ti and C is 66 at% Ti and 34 at% C. Clearly, more carbon is present in the NP core when methane is introduced during synthesis. Combined with the electron diffraction analysis, this proves the formation of a substoichiometric titanium carbide core. Note EDX

measuring condition and aquisitation time is kept same for the both the samples to observe the difference.