Synthesis of InN and InAlN nanoparticles in a pulsed plasma

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Semiconducting nanoparticles are of interest for applications that involve interaction with light. A low band gap semiconductor as InN allows for tuning the band gap via alloying with other materials like Ga or Al. For the implementation of nanoparticles in applications, an agglomeration of nanoparticles is undesired and a deposition technique that prevents agglomeration and allows for an even coverage of nanoparticles on the surface is desirable. Plasma-based synthesis of nanoparticles can fulfil these requirements because nanoparticles become negatively charged in the plasma – preventing agglomeration – and the nanoparticles can directly be deposited from the gas phase onto a surface. Besides the composition of the nanoparticle, the size and the shape of nanoparticles are also important properties that characterize the interaction with light. Hence, a technique that allows synthesizing nanoparticles in a controlled manner is desired. A technique that has proven to allow for controlled synthesis of nanoparticles was recently presented [1,2]. A high power pulsed hollow cathode was used to synthesize Cu nanoparticles. The size of the nanoparticles was controlled via the pulse parameters (e.g., frequency) in a range between 10 to 40 nm [1]. An advantage of the pulsed hollow cathode is the high degree of ionization and it was shown that the growth rate by collection of ions can be increased substantially when fostering growth by collection of ions [2]. In this contribution, the growth of InN nanoparticles is studied by sputtering an indium target in an atmosphere of nitrogen. The influence of discharge parameters and pressure on the growth is investigated. The aim of this study is to synthesize alloy nanoparticles of InAlN by co-sputtering aluminium.