Zn_3N_2 and Mg_3N_2 are non-toxic group-II nitrides and have band gaps of around 1 eV and 3 eV, respectively. This makes them attractive candidates for the application in optoelectronic devices. However, in order to evaluate these materials for device applications it is necessary to grow them in a sufficiently high quality and characterize their fundamental physical properties.

In this work we develop the epitaxial growth of Zn_3N_2 and Mg_3N_2 thin films by MBE. To prevent the decomposition of Mg_3N_2 thin films in air, polycrystalline MgO capping layers are grown *in-situ* in the MBE chamber. The film orientations of both Zn_3N_2 and Mg_3N_2 as well as their structural qualities for various film-substrate combinations are deeply analyzed by means of reflection high-energy electron diffraction, x-ray diffraction and/or transmission electron microscopy.

Besides the structural properties of Zn_3N_2 and Mg_3N_2 thin films, we explored some of their physical ones. Due to the sensitivity of II-nitrides towards humidity, a reliable determination of the optical band gap of Zn_3N_2 and Mg_3N_2 is challenging. By employing photoluminescence, diffuse reflectance and transmittance measurements we measure the band gap of our MBE-grown Mg_3N_2 thin films to be 2.9 eV at room temperature, as well as the band gap of MBE-grown Zn_3N_2 thin films to be 1.0 eV at room temperature (blue-shifted as a function of carrier concentration due to the Moss-Burstein effect). Finally, we established the linear thermal expansion coefficient for both materials and find average values of 1.5×10^{-5} K^{-1} and 1.1×10^{-5} K^{-1} in a temperature range from 300 K to 700 K-800 K for Zn_3N_2 and Mg_3N_2, respectively, three to four times higher than III-nitrides.