Local and electronic structure study of GaN based microrods for hydrogen generation from water

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Hydrogen energy is a highly promising one to protect the natural environment and to reduce pollution. The reduction of the CO_2 emission is the main objective but also a decrease of the reserves of traditional fossil energy reserves like coal, oil, and natural gas force to attach greater importance to developing renewable and environmental protection energy. Therefore, it is necessary to find proper solutions and develop various innovative materials like hydrogen production technologies. To obtain hydrogen, for instance, water electrolysis is adopted, or it is generated by photovoltaic power. Then the created hydrogen is stored through suitable storage, for example, in metal alloys or metal-organic frameworks (MOFs), and then generates hydrogen through fuel cells. It is already known that III-nitride (III-N) semiconductor-based light-emitting devices, e.g., LED, reduce energy consumption through the replacement of conventional light sources such as light bulbs or fluorescent lamps. Highly efficient long-lifetime solid-state light sources are already fabricated based on group III-N materials. Moreover, by engineering the energy gap of GaN by mixing with other nitrides such as AlN or dilute with other elements such as Mn one can obtain materials with application in UV emitter devices or in spintronics, respectively. The III-N materials need still to be explored from the viewpoint of physics but offer a very wide spectrum of applications. The most important feature of the III-N materials such as GaN or AlGaN is that they are not toxic to humans, in contrast to conventional II-VI or III-V compounds (based f.e. on Se, Cd or As). The safety of materials is crucial, thus from the environmental viewpoint, the use of III-V nitride-based devices for many applications is highly wanted to reduce energy consumption and protect our environment. Electrolysis is one possibility for carbon-free hydrogen production from renewable and nuclear resources. This process uses electricity to split water into hydrogen and oxygen. GaN-based compounds are proposed for the decomposition of water into H_2 and O_2 through a photocatalytic process since its conduction and valence-band edges straddle the oxidation-reduction levels of water. It was already demonstrated an efficient production of H_2 from water using a GaN photocatalyst with a NiO cocatalyst[1,2].
In the paper the XANES study of the GaN n-doped thin layers and microrods growth using Plasma Assisted Molecular Beam Epitaxy will be present.

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