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Title: Toward highly efficient p-doping in III-Nitrides Optoelectronics: MOCVD growth of Be-doped GaN
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Abstract: *P*-type doping in III-Nitrides has long presented a challenge in the development of wide bandgap optoelectronic devices. To date, Mg is the most common and only commercially viable acceptor in the III-Nitride materials system. Be, a common acceptor in other III-V materials such as GaAs, has been considered a potential alternative to Mg, and initial theoretical calculations as well as photoluminescence (PL) studies suggested that it is shallower than Mg in GaN. However, to date, there have been no reliable or repeatable examples of *p*-type GaN:Be in literature. More recent theoretical calculations predict a deep polaronic state 450–650 meV above the valence band edge, and these have been cited as evidence that conductive *p*-type GaN:Be is impossible. Despite this, the deep acceptor state has never been observed experimentally, and the shallow acceptor state is very commonly observed in PL studies.

Most prior work toward *p*-type GaN:Be has used molecular beam epitaxy (MBE) or ion implantation to dope GaN with Be. Due to the high toxicity of Be organometallics, investigation of GaN:Be grown using metal-organic chemical vapor deposition (MOCVD) has been nearly absent. Here, we present a systematic study of MOCVD-grown GaN:Be with varied doping conditions. All samples show prominent UV and yellow luminescence, characteristic of Be acceptor in GaN, and growth conditions resulting in high-quality GaN with stable Be incorporation were found.