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Groupe d'Étude
de la Matière Condensée

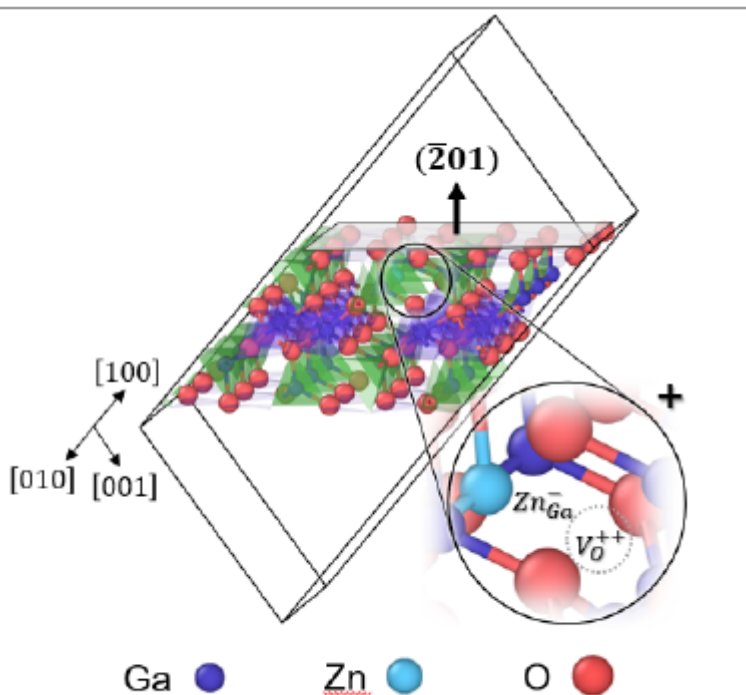
NATIVE “IMPERFECTIONS” ENABLES ROOM-TEMPERATURE P-TYPE CONDUCTIVITY IN α -Ga₂O₃

Researchers from GEMaC have demonstrated an important step for the realization of power electronics devices.

To realize the full functionality of any emerging electronic technology based on ultra wide bandgap semiconductors like α -Ga₂O₃, both n- and p-type conductivity (i.e., bipolarity) should be attained. Therefore, it is critical to identify, experimentally investigate, and control the concentration of the native point defects in α -Ga₂O₃ through growth parameters in order to determine the feasibility of achieving room temperature hole conductivity.

The motivation of the work featured in this highlight is to prove that native defects in α -Ga₂O₃ can enable the realization of high hole conductivity thanks to shallow acceptor centres.

In this work, within the framework of National “GOPOWER” and International “GALLIA” collaborative projects, researchers from GEMaC have demonstrated for the first time that Zn doping of α -Ga₂O₃/r-sapphire thin films grown by MOCVD technique can exhibit a long-time stable room-temperature hole conductivity with a conductivity activation energy of around 86 meV. The origin of this level might be attributed to a vacancy-zinc donor-acceptor complex (see figure). These results bring new evidence and help to break a “taboo” related to the feasibility of room temperature hole conductivity in Ga₂O₃ via traditional growth technique and doping. These results are likely to motivate further experimental research on the point defects in α -Ga₂O₃. From the practical point of view, this investigation increases the portfolio of techniques to achieve the much wanted homoepitaxial p-n junction for the emerging Ga₂O₃ ultra-wide semiconductor power electronics technology enabling, for example, proper ultra-high power PiN diodes.



Hypothetical crystal structure model of Zn-doped α -Ga₂O₃ containing a V_O⁺⁺-Zn_{Ga}⁻ defect complex

Référence

Z. Chi, C. Sartel, Y. Zheng, S. Modak, L. Chernyak, C. M Schaefer, J. Padilla, J. Santiso, A. Ruzin, A.-M. Gonçalves, J. von Bardeleben, G. Guillot, Y. Dumont, A. Pérez-Tomás, E. Chikoidze, **"Native defects association enabled room-temperature p-type conductivity in α -Ga₂O₃"**,

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