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Getting the signatures of gallium oxide impurities FREE

Chris Patrick

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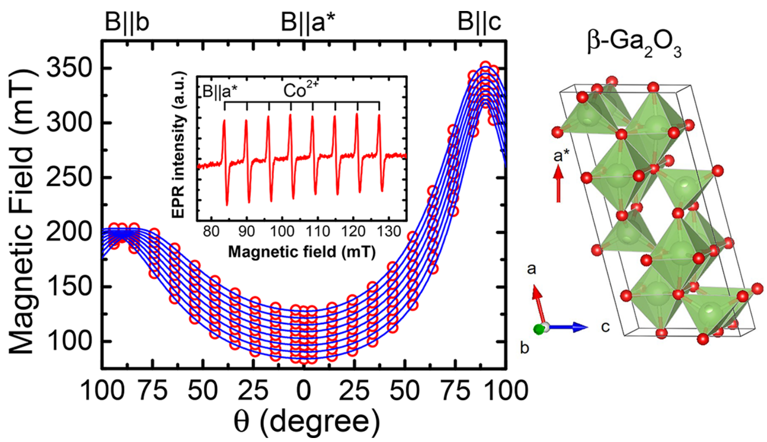
Obtaining the electron paramagnetic resonance signatures of cobalt and copper, two impurities often found in gallium oxide, could help control the properties of this promising semiconductor.



Gallium oxide (Ga_2O_3), a wide-bandgap semiconductor, possesses the potential to perform well in a wide range of devices, including transparent conducting electrodes, photoelectrochemical water splitting and ultraviolet optoelectronic devices. For certain classes of power electronics, Ga_2O_3 could even outperform current state-of-the-art materials.

But first, researchers must be able to control the electrical and optical properties of Ga_2O_3, which means understanding its impurities. To learn more about these impurities, Stehr et al. identified the previously unknown electron paramagnetic resonance (EPR) signatures of cobalt (Co) and copper (Cu) in β-Ga_2O_3, a stable crystalline phase of Ga_2O_3. These transition metals are both impurities often found or used as dopants in Ga_2O_3.

EPR spectroscopy identifies impurities in semiconductors without destroying the material. The authors used this technique to determine the electronic signatures and geometric arrangement of Co and Cu in β-Ga_2O_3 bulk crystals and powder. They found that both Co and Cu are present in undoped β-Ga_2O_3 in the 2+ charge state and prefer to reside on the octahedral gallium lattice site.

“Cobalt can have a profound effect on the electrical properties by altering the Fermi level and, thus, device performance,” said author Jan Stehr. Copper can also alter device performance: Used as a dopant, it may introduce a shallow acceptor level, which might make Ga_2O_3 more suited for application in bipolar devices.

These obtained parameters can act as signatures of cobalt and copper and be used for their identification.

Source: “Electron paramagnetic resonance signatures of Co^{2+} and Cu^{2+} in β-Ga_2O_3,” by Jan E. Stehr, Detlev M. Hofmann, Jörg Schörmann, Martin Becker, Weimin M. Chen, and Irina A. Buyanova, *Applied Physics Letters* (2019). The article can be accessed at https://doi.org/10.1063/1.5127651.

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