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SUPPLEMENTARY INFORMATION

Exploring swift-heavy ions irradiation of InGaN/GaN multiple quantum wells for green-emitters: the use of Raman and photoluminescence to assess the irradiation effects on optical and structural properties

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S1. Optical transmittance of *c*-plane GaN layers irradiated with Xe swift-heavy ions

Figure S1 shows the optical transmittance spectra of *c*-plane GaN layers grown on Al_2O_3 substrates before (*c*-GaN as-grown) and after irradiation with 74 MeV Xe swift-heavy ions (*c*-GaN-74). As observed for the InGaN/GaN MQWs, the spectrum reveals a well-defined GaN near band edge (NBE) absorption at 3.4 eV that redshifts after irradiation and becomes less steep. In addition, it is possible to observe the irradiation-induced absorption band (irr-AB) at about 2.75 eV. This band is similar to the observed in Xe SHI irradiated InGaN/GaN MQWs (Fig. 1b in the main manuscript), suggesting that the mid-gap states involved in such absorption are related to GaN.

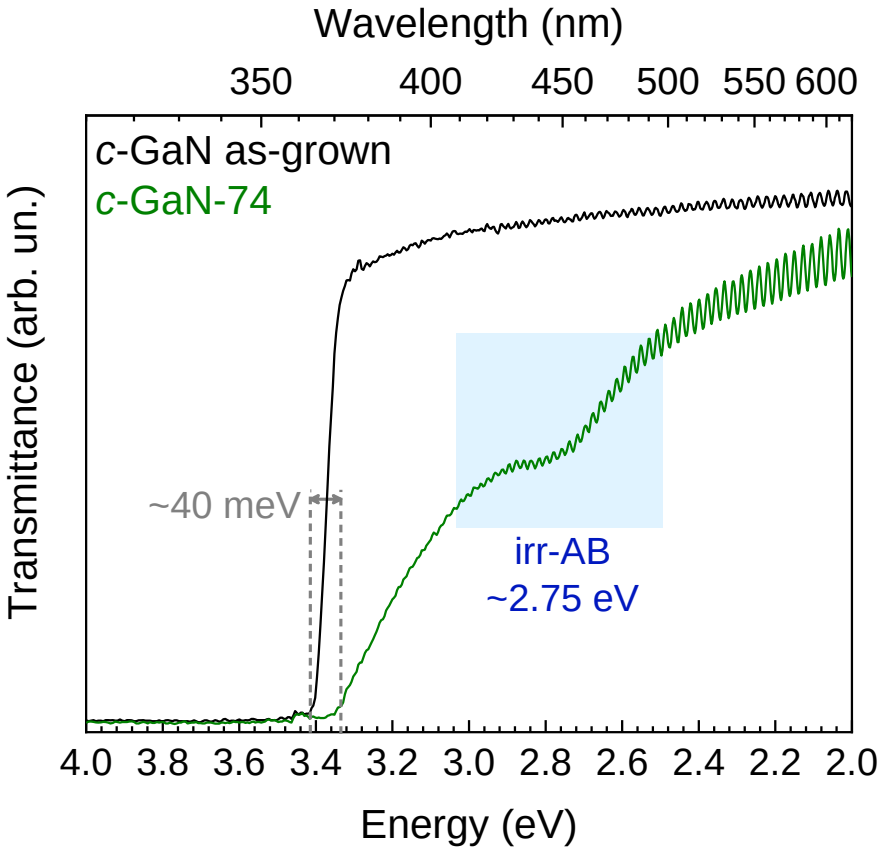

Figure S1. Optical transmittance spectra of the samples c-GaN as-grown and c-GaN-74.

S2. X-ray diffraction of the InGaN/GaN multiple quantum wells (MQWs) as-grown

X-ray diffractometry (XRD) measurements were performed using Cu $K\alpha_1$ X-rays on the high-resolution diffractometer Bruker D8 AXS with a Goebel mirror and a two-reflection Ge(220) monochromator in the primary beam and an analyser coupled to a scintillation counter.

Figure S2 shows a (002) normalized high-resolution 2Theta/Omega diffractogram recorded for the MQW-asgr sample (solid black lines). The fit (solid red line) was made using the GID_sl software at Sergey Stepanov's X-Ray Server.[1,2] For the GID_sl calculations, the MQW structure was assumed to consist of five periods containing 2.6 nm of fully strained $In_{0.2}Ga_{0.8}N$ QWs and 11.0 nm of GaN barriers. The above values are within good agreement with those obtained using RBS and inferred from PL/Raman.

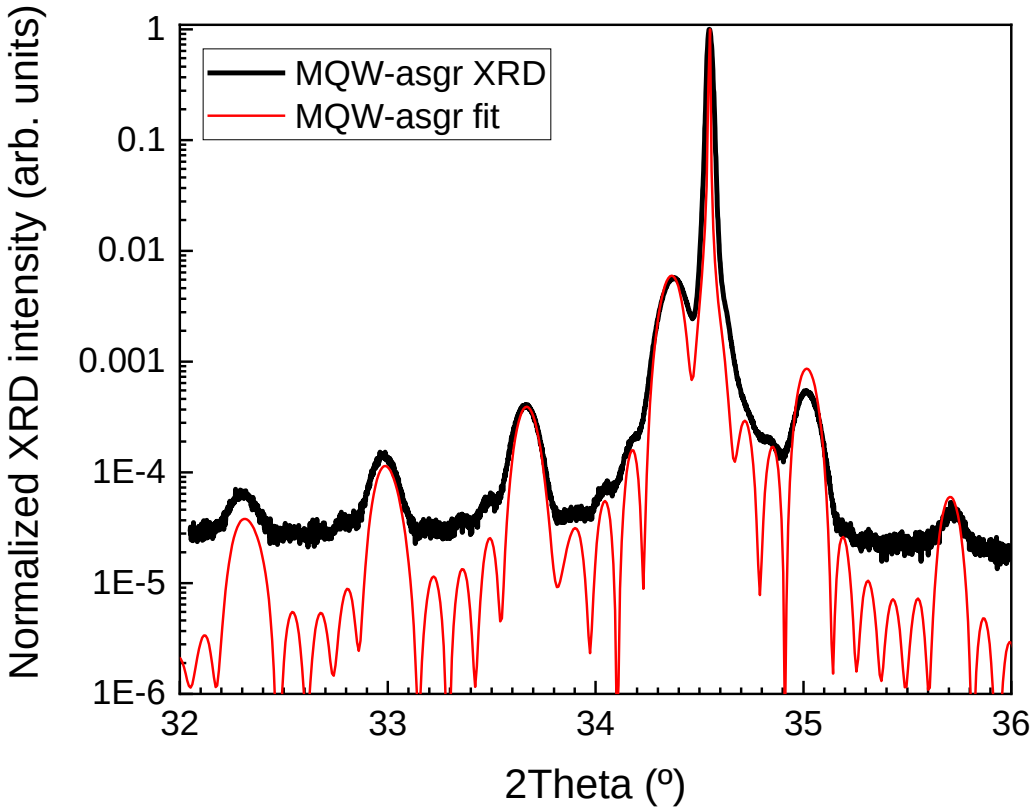

Figure S2. High-resolution XRD diffractogram recorded for the InGaN/GaN MQWs as-grown (black solid line) and the fit to the experimental data using the GID_sl software at Sergey Stepanov's X-Ray Server[1,2] (red solid line).

References

1 S. A. Stepanov, X-Ray Server, https://x-server.gmca.aps.anl.gov, (accessed 8 June 2021).

2 S. A. Stepanov, in *Advances in Computational Methods for X-Ray and Neutron Optics, Proc. SPIE v.5536*, ed. M. Sanchez del Rio, 2004, pp. 16–26.