

Measurement of the transport properties of InGaN/GaN heterostructure analyzed using a two-layer model

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This dataset includes transport measurements data of InGaN epilayer grown by MOCVD on a semiconducting GaN template substrate. This dataset was used in the article published in Materials Science in Semiconductor Processing **Yusof et al. [1]** (<https://doi.org/10.1016/j.mssp.2022.106614>). A two layer model was used to precisely extract the electrical properties of the InGaN epilayers, as developed in the article. The Python code used to plot and analyze the experimental data is included alongside with the data. Are also included the X-ray diffraction and photoluminescence data. The dataset contains:

- the measured data in ASCII format.
- the Python code used to view and analyze the data.
- this PDF file describing the dataset.

References:

- This dataset: <https://doi.org/10.12763/QXFWRQ>
- The corresponding article using these data: <https://doi.org/10.1016/j.mssp.2022.106614>

Keywords: InGaN, Epitaxy, MOCVD, Thin-Film, Characterization, Van der Pauw, Hall effect, Two-layer Model, Solar Cell.

1. SAMPLES

Table 1 gives the samples elaboration parameters, and **Table 2** gives the GaN/sapphire substrate transport properties.

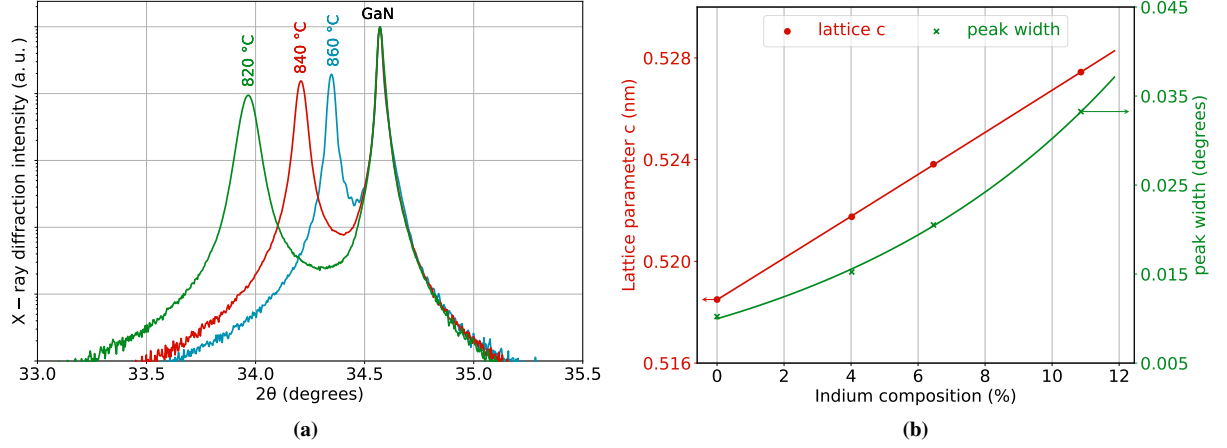
Table 1. InGaN/GaN samples main MOCVD elaboration parameters. The layers thicknesses were measured using field emission scanning electron microscopy. The InGaN thickness is about 350 nm for all considered compositions. The TEG and TMI flow rates were fixed at 69.3 sccm and 184 sccm respectively; the V/III and TMI/III ratios were fixed at 15777 and 57 % respectively.

Structure	Growth temperature (°C) and duration	Indium composition x (%) from XRD	Indium composition x (%) from PL	Total thickness (μm)
GaN/sapphire	1120 60 minutes	—	—	3.850
InGaN/GaN/sapphire	860 direct growth 252 minutes	04.02	03.91	4.200
InGaN/GaN/sapphire	840 direct growth 252 minutes	06.46	06.64	4.200
InGaN/GaN/sapphire	820 direct growth 252 minutes	10.86	11.50	4.200

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Table 2. The GaN/sapphire substrate mobility, conductivity and carrier concentration. The GaN thickness was measured using field emission scanning electron microscopy as for InGaN/GaN heterostructures.

Thickness t_s (μm)	Conductivity σ_s ($\Omega^{-1}\text{cm}^{-1}$)	Mobility μ_s ($\text{cm}^2\text{V}^{-1}\text{s}^{-1}$)	Concentration n_s (cm^{-3})
3.850 ± 0.010	2.734 ± 0.005	174 ± 1	$(9.8 \pm 0.2) \times 10^{16}$

**Figure 1.** XRD diffractograms (1a) of InGaN/GaN heterostructures and the InGaN lattice parameter and peak width (1b) with respect to the InGaN growth temperature. The extracted indium compositions are: 04.02 % for a growth temperature of $T = 860$ °C; 06.46 % for $T = 840$ °C and 10.86 % for $T = 820$ °C.

2. EXPERIMENTAL SETUP

The measurements were performed using a home made van der Pauw / Hall effect setup with a 0.55 T permanent magnet and two source-measure units (Keithley 2602 and 2636B models). Details are given in the article using this dataset Yusof *et al.* [1].

3. FIGURES

The figures corresponding to the dataset are shown in **Figure 1**, **Figure 2**, **Figure 3** and **Figure 4**.

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- [1] A S Yusof, S Ould Saad Hamady, C Chevallier, N Fressengeas, Z Hassan, S S Ng, M A Ahmad, W F Lim, and M A Che Seliman. Analysis using a two-layer model of the transport properties of InGaN epilayers grown on GaN template substrate. *Materials Science in Semiconductor Processing*, 144:106614, 2022.

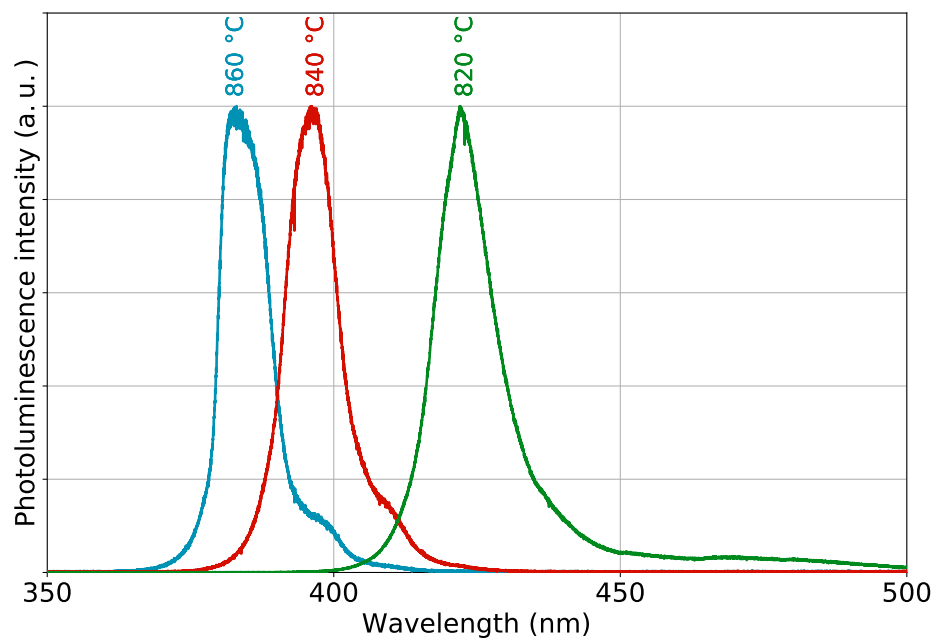


Figure 2. Room temperature normalized photoluminescence spectra of InGaN/GaN heterostructure as a function of InGaN growth temperature. The extracted indium compositions are 03.91 % for a growth temperature of $T = 860\text{ }^{\circ}\text{C}$; 06.64 % for $T = 840\text{ }^{\circ}\text{C}$ and 11.50 % for $T = 820\text{ }^{\circ}\text{C}$.

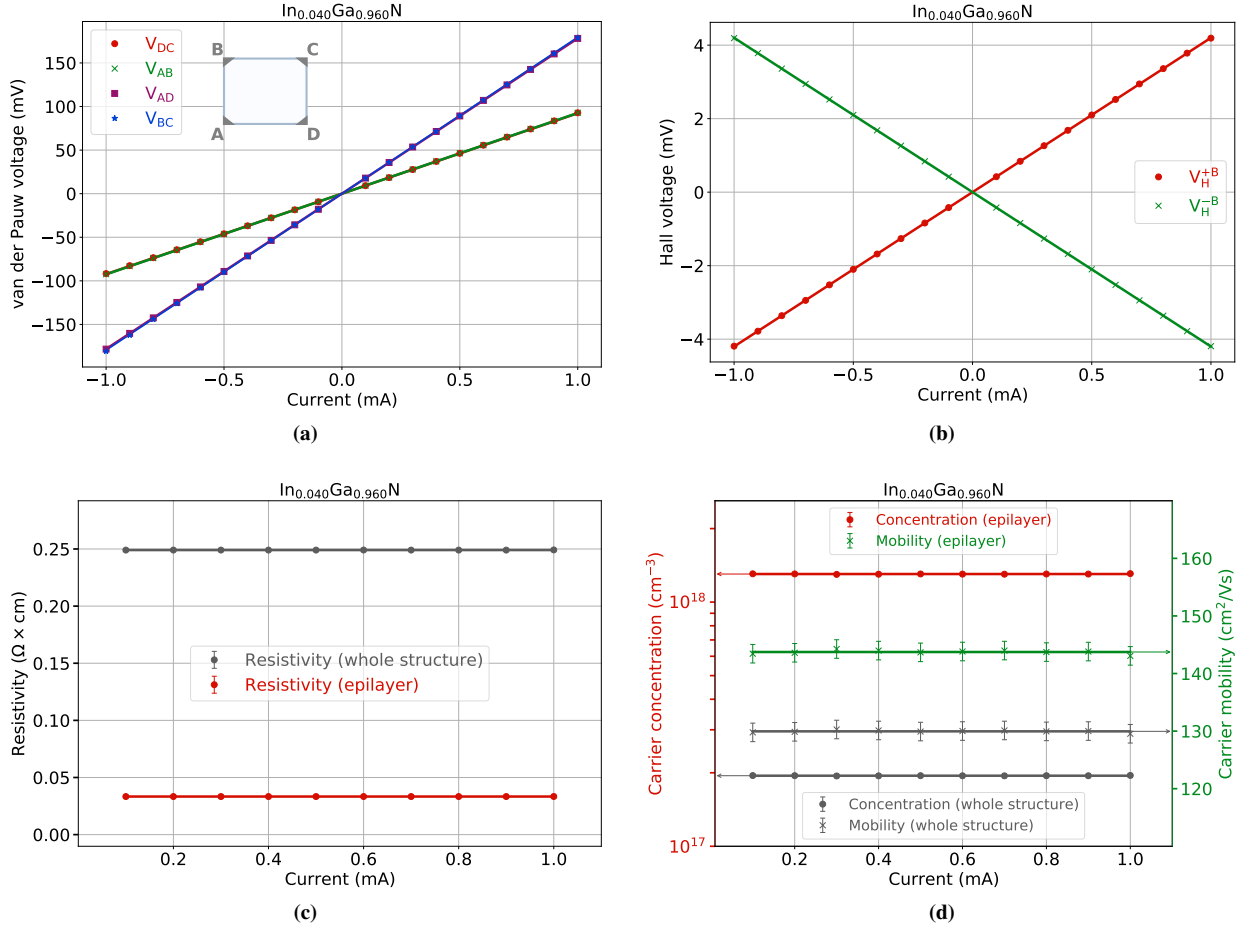


Figure 3. Van der Pauw voltages with respect to the injected current (3a) with the nomenclature defined in Yusof *et al.* [1]; Hall voltages, corrected from the voltage offset, with respect to the injected current and for the two forward and reverse magnetic field (3b); Resistivity (3c), carrier concentration and mobility (3d) for InGaN/GaN structure with an indium composition of 04.02 %. For the resistivity and carrier concentration, the error bars are plotted even if they are not clearly visible due to the log scale (for concentration) and their small values (for resistivity).

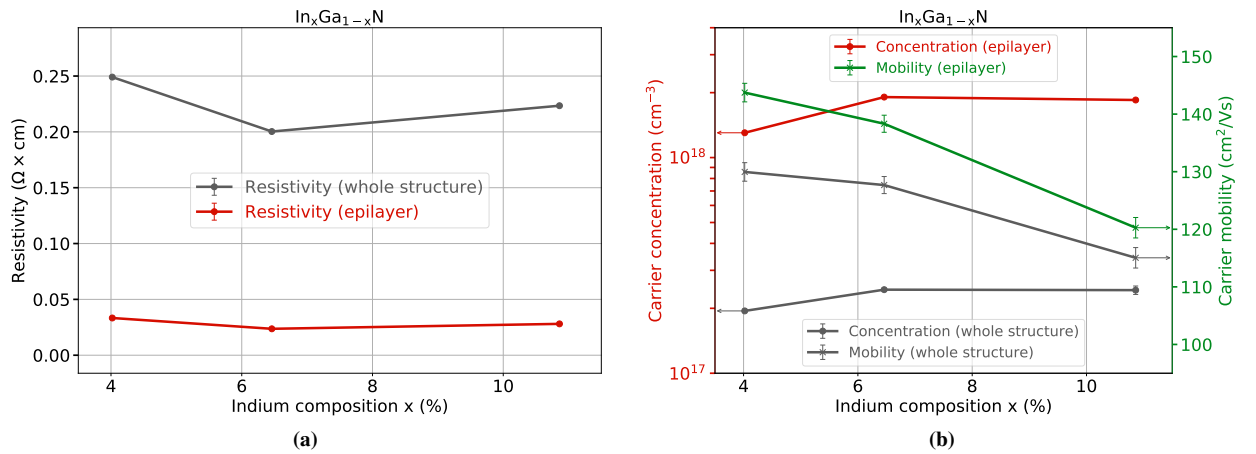


Figure 4. Resistivity (4a), carrier concentration and mobility (4b) for InGaN/GaN structure and the extracted InGaN epilayer values, with respect to the indium composition.