Supplementary

Room temperature ferromagnetism in \textit{nonmagnetic} Cu doped GaN nanowires

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**Supplementary Information, S1**

**Fig. S1** Synchrotron x-ray diffraction (XRD) scans for nanowires; (·) GaN and (A) sapphire substrate. The inset shows the shift in the peak to the left from pure GaN, Ga$_{1-x}$Cu$_x$N nanowires for $x = 0.01$ and 0.024, respectively. A clear shift in the peaks to lower angles was observed at higher concentrations of Cu ions. This indicates an increase in the lattice constant with Cu doping, which is expected as larger Cu ions are incorporated into the Ga sites.
Supplementary Information, S2

Fig. S2 Temperature dependent resistance of typical Ga$_{1-x}$Cu$_x$N nanowires. For 4-probe resistance measurements of Ga$_{1-x}$Cu$_x$N nanowires, we contacted metal electrode to a single nanowire as follows. Electrical contacts were made to a single nanowire as follows. First, alignment marks consisting of a metal dot array with about 1 µm spacing were fabricated to identify the location of the nanowires. A suitable nanowire was selected by using SEM. Once the nanowire was found, its position was determined relative to the alignment marks. A two-layer e-beam resist (PMMA/copolymer) was then spun over the sample and the patterns for electrical leads were generated using e-beam lithography techniques onto the pre-selected nanowire. Then Ti (~ 45 nm) and Au (~ 35 nm) were sequentially deposited on the contact area by thermal evaporation, followed by lift off and forming the electrodes. The Ga$_{1-x}$Cu$_x$N nanowires show semiconducting property.
Fig. S3 XMCD data from the difference between the Ni $L_{2,3}$-edge XAS spectra for the different spin directions of Ga$_{1-x}$Cu$_x$N nanowires for $x = 0.01$ and 0.024 measured at 10 K. No detectable dichroism peaks related on the any Ni impurities were observed at the same samples.