Electronic Supplementary Material (ESI) for ChemComm.

Supporting information:

Electrodeposition of Gallium in the presence of NH_4Cl in an ionic liquid: Hints for GaN formation

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Experimental Methods

1-butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)amide ($[Py_{1,4}]Tf_2N$) was purchased in the highest available quality from Io-Li-Tec (Germany) and was used after drying under vacuum at 100 ^oC to remove the water content to below 2 ppm. $GaCl_3$ (99.99 %) and NH_4Cl (99.9 %) salts were purchased from Alfa Aesar. The working electrodes were copper plates. Prior to use, the copper plates were polished, rinsed in acetone and then in ethanol in an ultrasonic bath to minimize possible surface contaminations as well as possible. Platinum wire and platinum ring were used as a counter and a quasi-reference electrodes, respectively, which gave good stability in the ionic liquid throughout the experiments. The electrochemical cell was made of Teflon and clamped over a Teflon-covered Viton O-ring onto the substrate, yielding a geometric surface area of 0.3 cm^2. Prior to the experiments, the Teflon cell and the O-ring were cleaned in a mixture of 50:50 vol% of concentrated H_2SO_4 and H_2O_2 (35%) followed by refluxing in distilled water.

The electrochemical measurements were performed in an argon-filled glove box with water and oxygen contents of below 2 ppm (OMNI-LAB from Vacuum Atmospheres) by using a VersaStat II (Princeton Applied Research) potentiostat/galvanostat controlled by powerCV. The entire scan rate during cyclic voltammetry was 10 mV sec^{-1}. After the constant potential deposition, the deposit was washed in isopropanol and acetone to remove any remaining ionic liquid.

A high resolution SEM (Carl Zeiss DSM 982 Gemini) was employed to investigate the surface morphology of the deposited films. X-ray diffraction patterns were recorded at room temperature using a PANalytical Empyrean Diffractometer with Cu K_α radiation. The IR and Raman spectra were recorded using a Infrared Fourier Vacuum Spektrometer (VERTEX 70V from Bruker Optics GmbH) and by a Bruker Senterra Raman microscope, respectively.

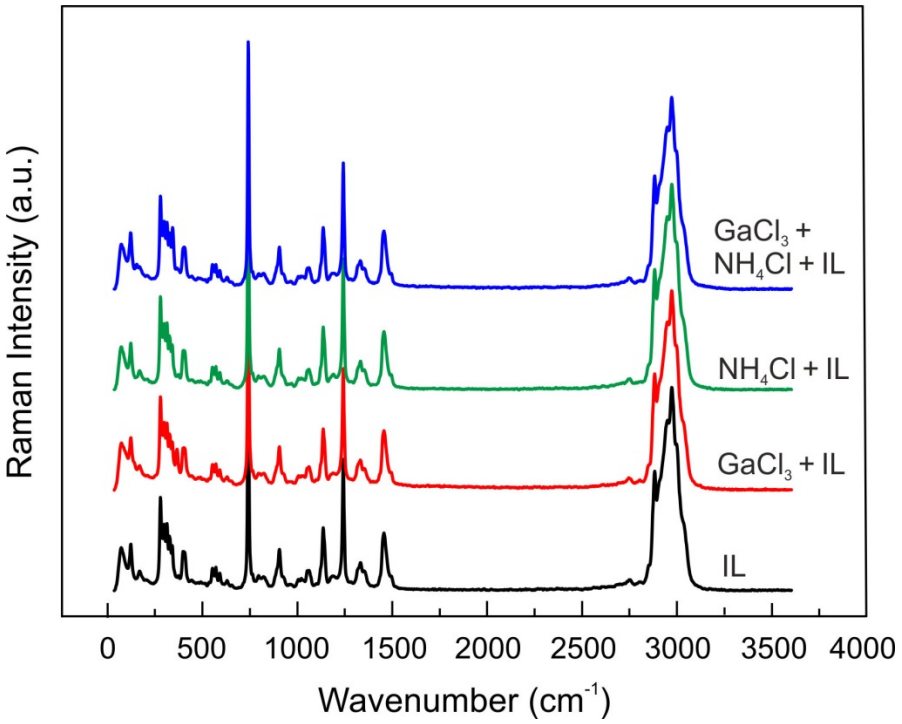

Figure S1: Raman spectra of IL (black), $GaCl_3$+IL (red), NH_4Cl+IL (green) and $GaCl_3$+NH_4Cl+IL (blue).

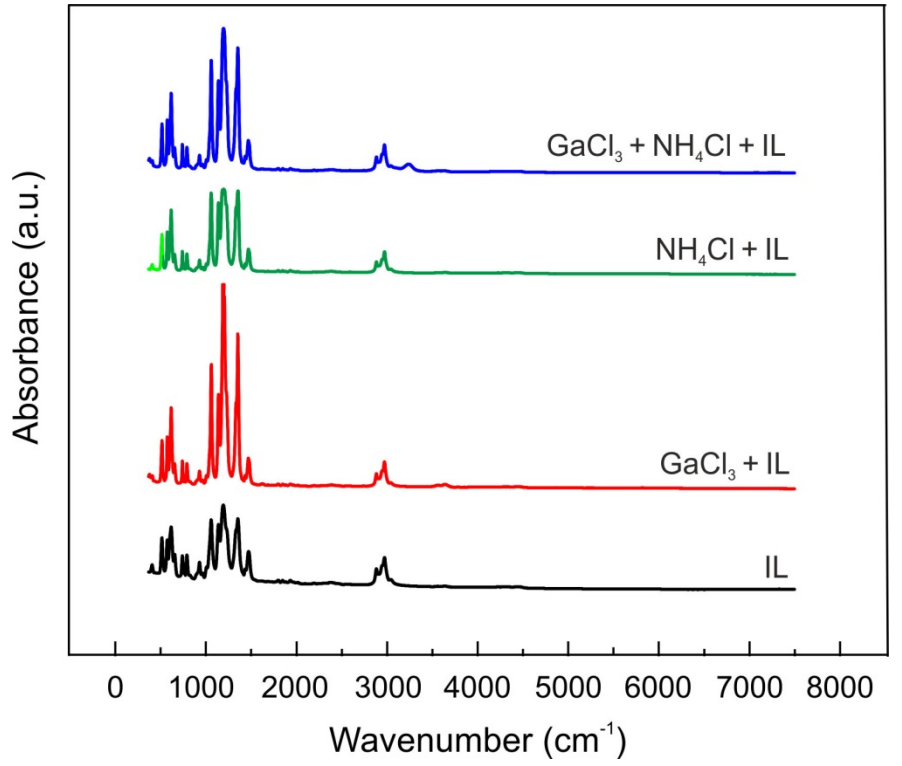

Figure S2: IR spectra of IL (black), $GaCl_3$+IL (red), NH_4Cl+IL (green) and $GaCl_3$+NH_4Cl+IL (blue).

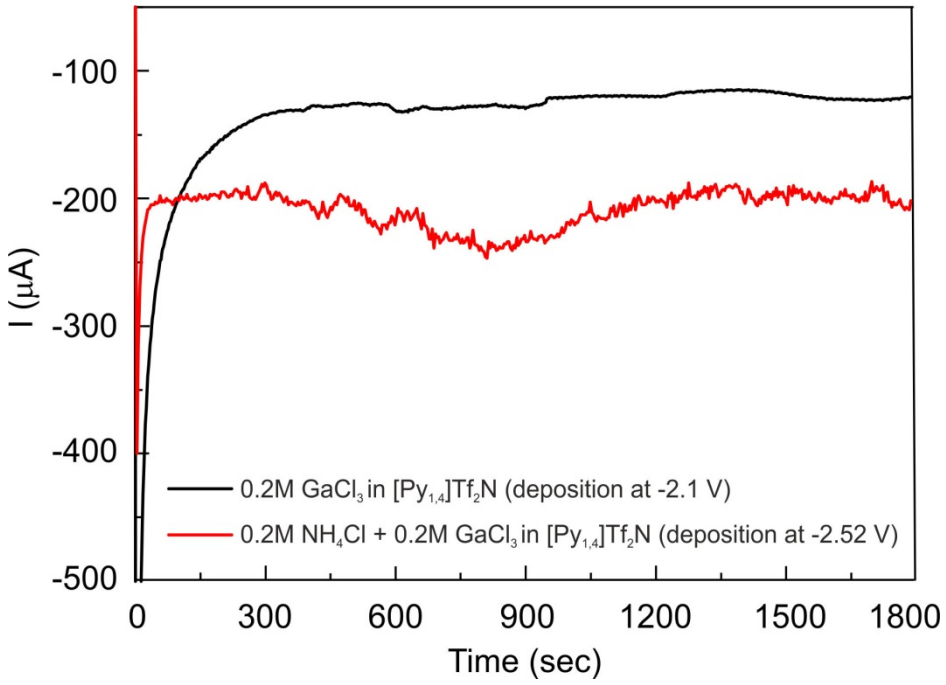

Figure S3: Current-Time plot during electrodeposition of Ga (black line) and GaN (red line).