A New Room-Temperature Emitter in High-Quality Hexagonal Boron Nitride: Supplemental Material

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I. DESCRIPTION OF $g^{(2)}$ MEASUREMENT VIA HBT INTERFEROMETRY

The electron beam is continuously scanned over a 500 nm square subsection of a h-BN flake containing emissive features in the relevant spectral band. Emitted light is first filtered using a 460/50 bandpass filter (Semrock). The filtered light is coupled to a 50/50 split fiber (Thorlabs TM105R5S1A) using a parabolic reflector. Each end of the split fiber is directed toward a Silicon avalanche photodiode (MPD PD-100-CTE-FC). A 470/100 bandpass filter (Semrock) is placed before each detector to reduce the silicon afterglow effect. Photon timing data are acquired using a PicoHarp 300 (PicoQuant) operated in T2 mode. Timing data are acquired for 30-60 minutes. We monitor the total number of timing events recorded and stop integration between 10-100 million events. Coincidences from the raw timing data are placed into bins between 50-500 ps. We assume that events at long delay times are dominated by the Poissonian statistics of the electron beam and normalize the raw coincides at this level to 1. Finally, we obtain the $g^{(2)}$ correlation function using:

$$g^{(2)}(\tau) = \left(\mathrm{C}(\tau) - \left(1 - \rho^2\right)\right)/\rho^2, \tag{1}$$

where $\rho = \mathrm{Signal}/(\mathrm{Signal} + \mathrm{Background})$ and $\mathrm{C}(\tau)$ is the normalized coincidence histogram. Background count rates are estimated by measuring the count rate far from an emitter. Typical count rate values are 1-3 kHz for the background and 10-20 kHz for the emitters.

II. MULTI-GAUSSIAN PEAK FITTING OF EMISSION SPECTRUM: ZPL AND PHONON REPLICAS

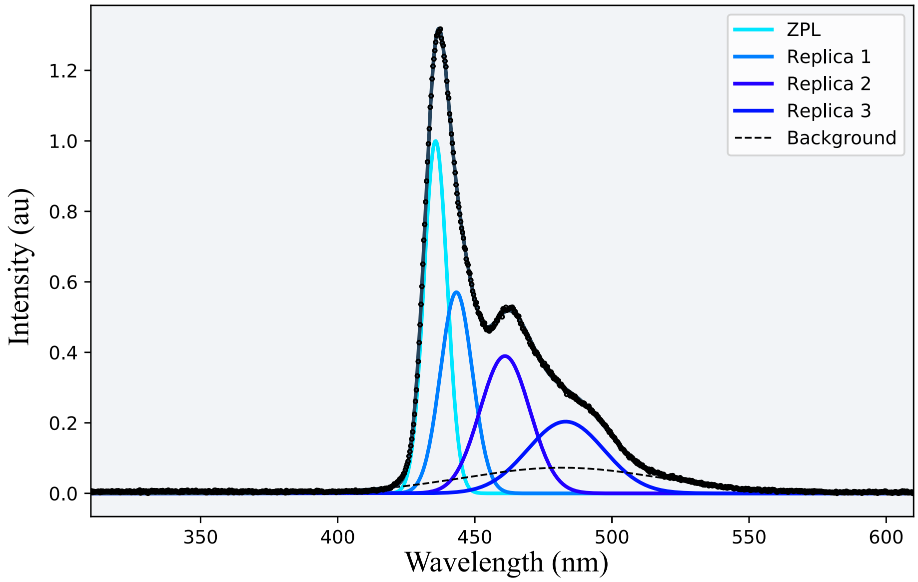

FIG. 1. Result of multi-Gaussian peak fitting of emission spectrum.

Peak Name	ZPL	Replica 1	Replica 2	Replica 3	Background
Peak Intensity	1	0.571	0.390	0.204	0.073
Center (nm)	435.7	443.3	461.0	483.1	481.8
FWHM (nm)	10.0	13.7	21.4	33.0	84.8
Center (eV)	2.846	2.797	2.690	2.566	2.573
FWHM (meV)	65	87	125	175	456

TABLE I. Summary of best-fit parameters for multi-Gaussian peak fitting to emission spectrum. Peak positions and widths have been listed in both wavelength and energy units for convenience.

III. NMF COMPONENTS AND ERROR ANALYSIS

Spectral image MVA decomposition is performed using the HyperSpy package in the Python programming language. In order to determine the number of components a singular value decomposition is first performed, and the number of decomposition components for the final model is chosen by inspection of the PCA Scree plot. The final decomposition is performed using non-negative matrix factorization (NMF) with the reduced number of final components.

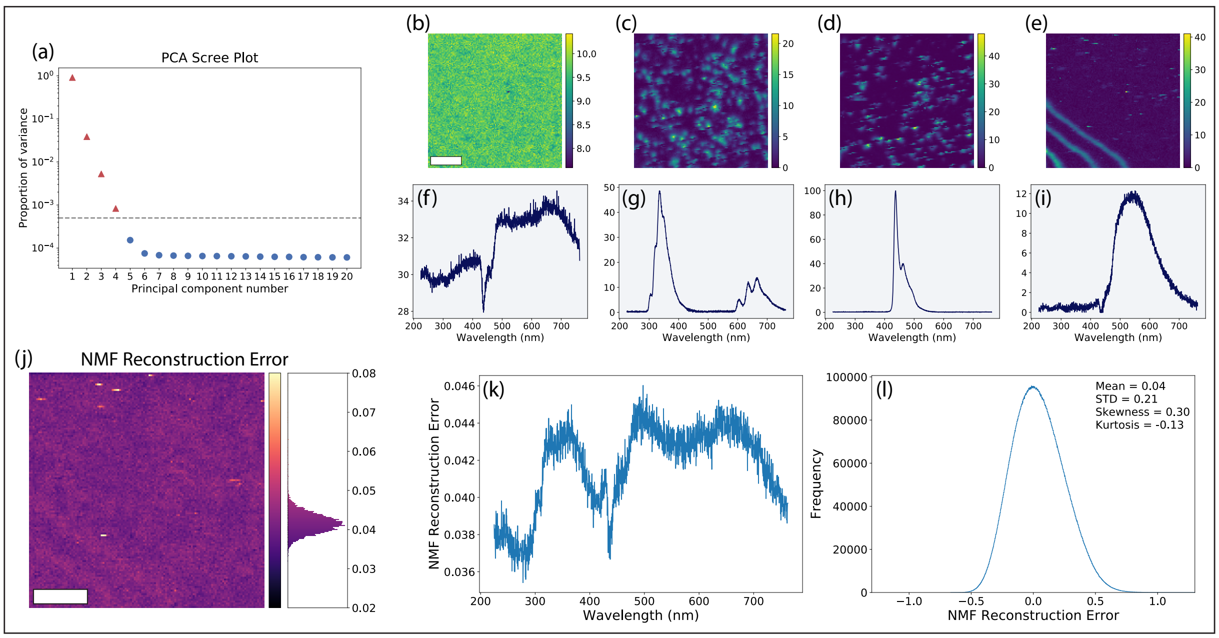

FIG. 2. Summary of NMF decomposition of hyperspectral data. The number of components was chosen by inspection of the PCA Scree plot in (a). An arbitrary threshold of 0.0005 was chosen. Panels (b-e) show each of the NMF spatial components (loadings) with panels (f-i) showing the associated spectral components (factors). The scale bar is 1 um. The mean reconstruction error per spatial pixel is shown in panel (j). Panel (k) shows the mean reconstruction error per spectral pixel. Panel (l) shows a histogram of the reconstruction error for each voxel of the data set along with selected statistics.