ERRATUM

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Erratum: Confocal scanning photoluminescence for mapping electron and photon beam induced microscopic changes in SiN_x during nanopore fabrication (2020 *Nanotechnology* 31 395202)

Xiaodong He[1,2], **Zifan Tang**[1], **Shengfa Liang**[3], **Ming Liu**[3] **and Weihua Guan**[1,4,5]

[1] Department of Electrical Engineering, Pennsylvania State University, University Park, PA 16802, United States of America
[2] School of Information Science and Engineering, Lanzhou University, Lanzhou 730000, People's Republic of China
[3] Key Lab of Microelectronic Devices & Integrated Technology, Institute of Microelectronics, Chinese Academy of Sciences, Beijing 100029, People's Republic of China
[4] Department of Biomedical Engineering, Pennsylvania State University, University Park, PA 16802, United States of America
[5] Materials Research Institute, Pennsylvania State University, University Park, PA 16802, United States of America

E-mail: w.guan@psu.edu

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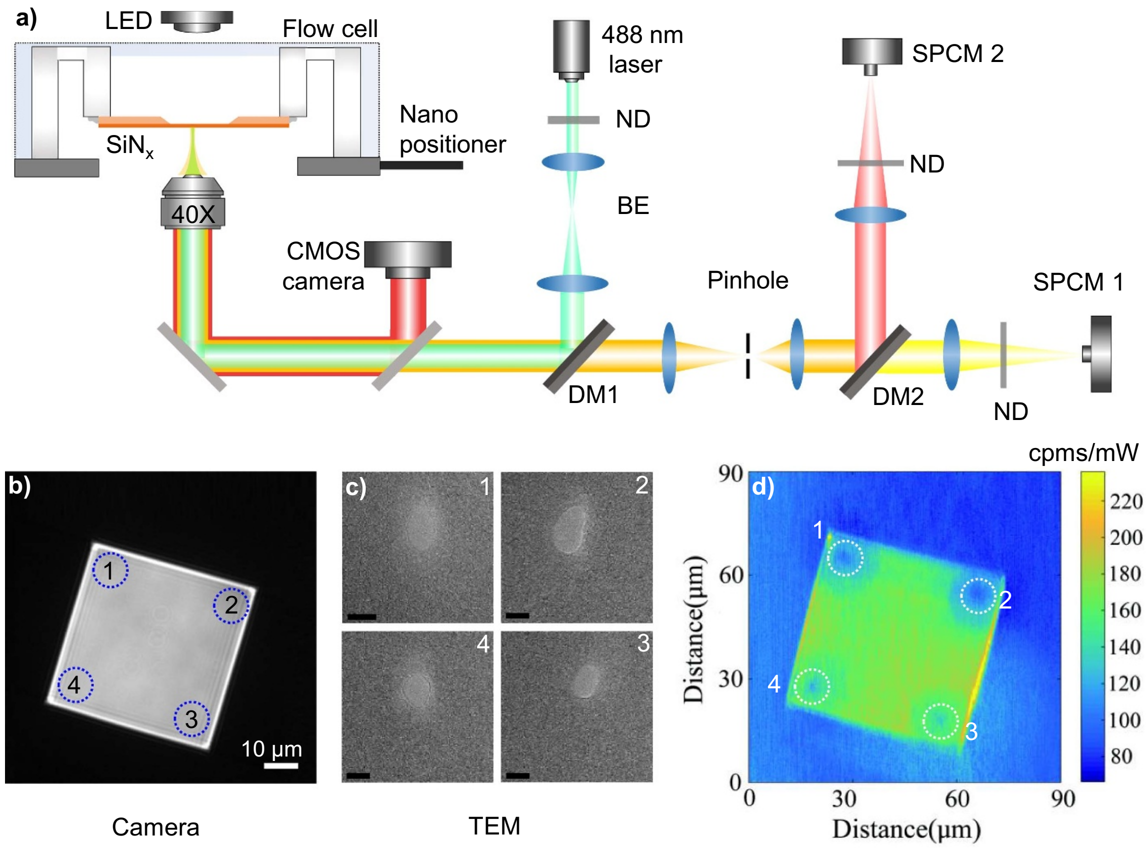

Figure 1. (a) Experimental setup of the confocal scanning PL system. (b) Microscope image of the entire SiN_x membrane (50×50 μm^2) in which four nanopores were drilled with highly focused e-beam near the four corners. (c) TEM images of the as drilled nanopores, scale bar for all TEM images is 10 nm. (d) PL map of the SiN_x sample (10 mW 488 nm excitation, 2 ms photon counter integration time, 300 nm scan step). The counted emission photons were normalized to the integration time and the incident laser power (cpms: counter per millisecond).

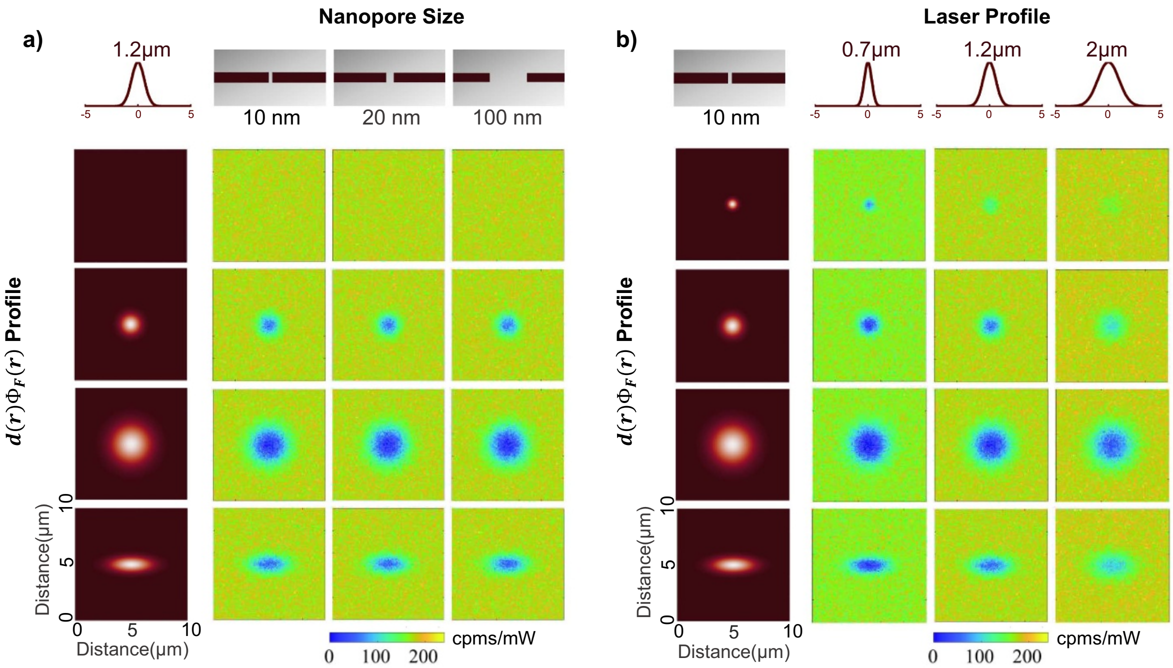

Figure 2. (a) Simulated PL maps under various nanopore sizes (columns) and material's microscopic profiles (defined as the product of the quantum yield and the thickness, rows). The excitation laser spot size is fixed at 1.2 μm. Note that the material's microscopic profiles from the 2nd to 4th row spreads several microns, much larger than typical nanopore dimensions. The resulting PL map is highly correlated to the microscopic profiles and is independent of the nanopore size. (b) Simulated PL maps under various laser spot sizes (columns) and material's microscopic profiles (rows). The nanopore size is fixed at 10 nm. A tightly focused laser can improve the resolution of the scanned PL. All of the simulations were carried out at laser power 1 mW, integration time 2 ms and scanning step 100 nm. The thickness and the quantum yield in the intact membrane is 30 nm and 1%, respectively.

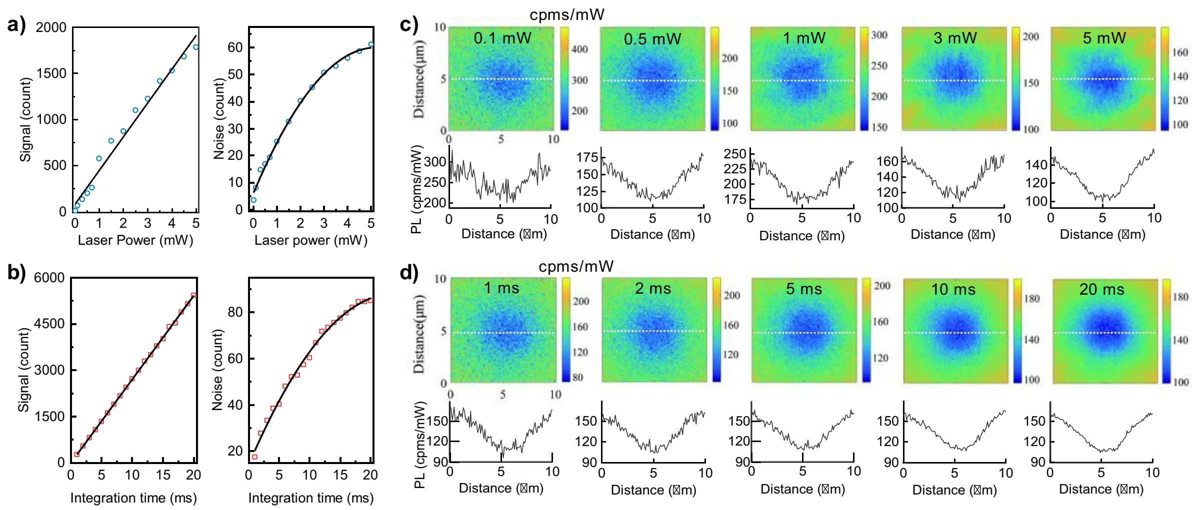

Figure 3. (a) The PL signal and noise from a 30 nm thick SiN_x membrane at different laser powers (2 ms integration time). (b) The PL signal and noise at different integration times (constant 1 mW laser power). The open circles and squares are experimental data. Lines are linear and square root fitting. Each data point was from 10 measurements. (c) PL maps of a 10 nm-sized nanopore in the center of the SiN_x membrane under various laser power (2 ms integration time) with the corresponding line profiles. (d) PL maps of the same sample at various integration time (constant 1.5 mW laser power), with the corresponding line profiles plotted underneath.

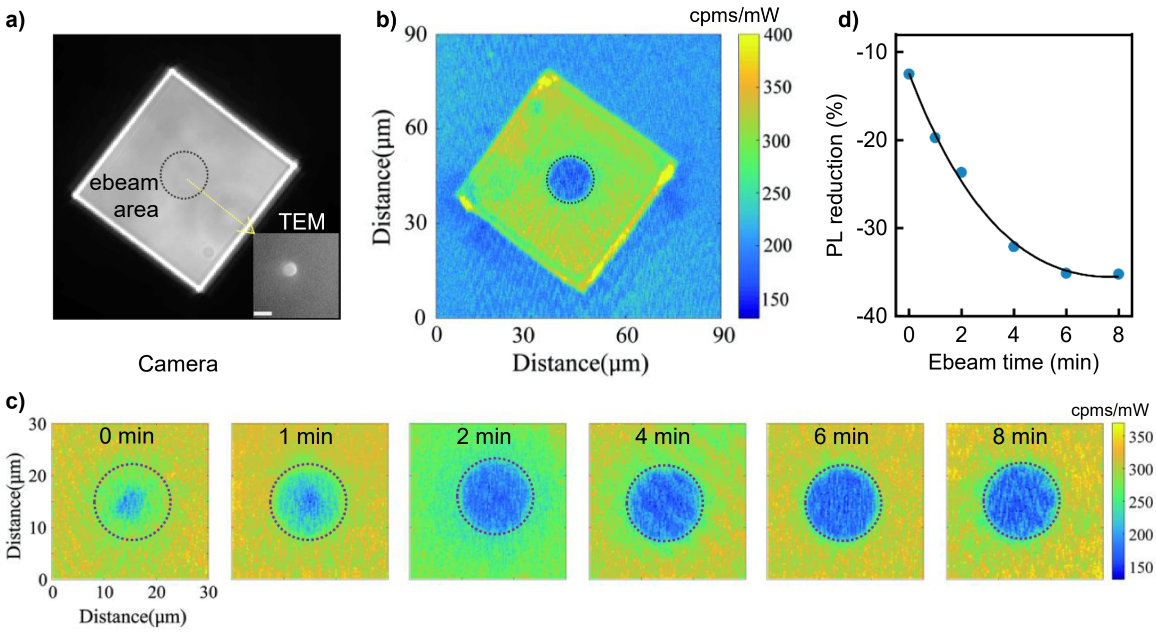

Figure 4. (a) The image of a 50 × 50 μm^2 SiN_x membrane showing a 14 μm diameter sized area (dashed circles) where the non-etching e-beam was irradiated (beam current 158 μA). The inset shows the nanopore in the center of this irradiation area (scale bar, 10 nm). (b) The resulting PL map with 8 min e-beam irradiation. (c) PL maps at various e-beam irradiation time (0 min means no additional exposure after drilling the nanopore). (d) The PL reduction percentage as a function of e-beam irradiation time. The solid line is an exponential fit to the experiment data (blue dots). The PL maps were obtained under laser power 1 mW, integration time 2 ms, and scanning step 300 nm.

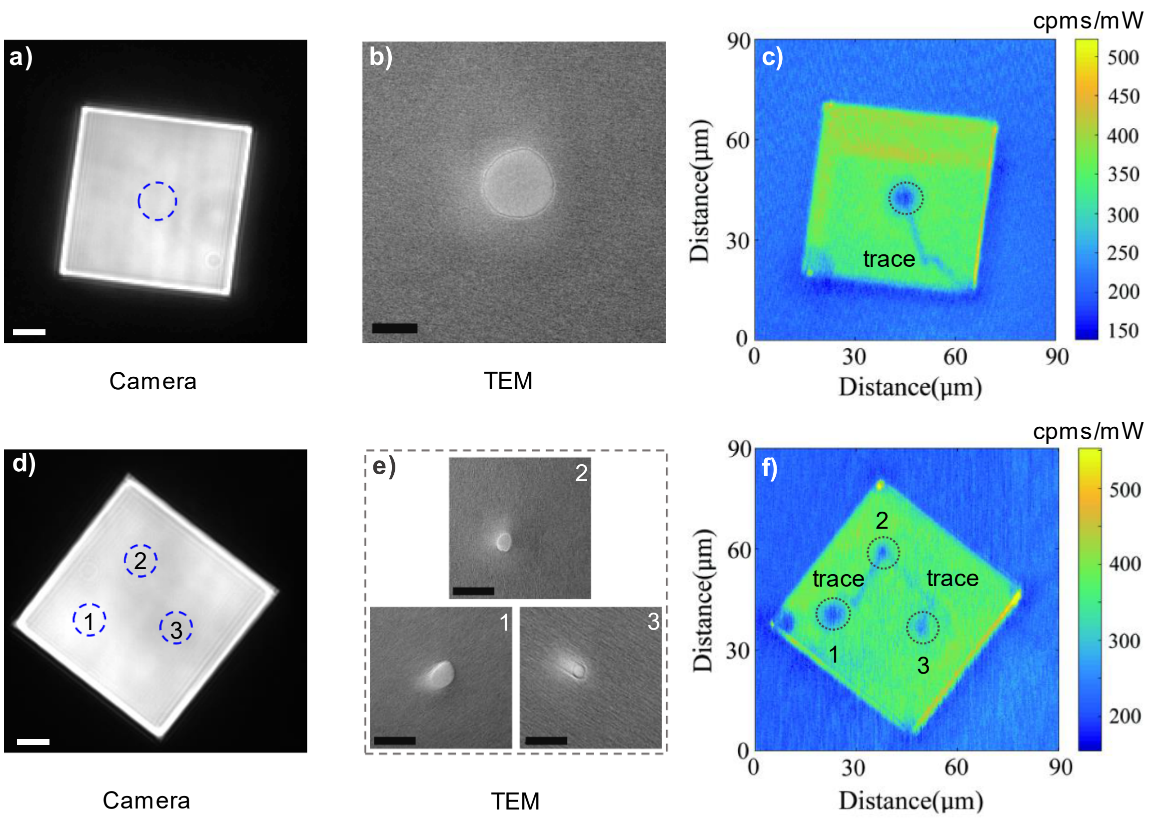

Figure 5. (a) Microscope image of a SiN_x membrane in which a single nanopore was drilled in the center, the e-beam was moved from the right-bottom corner to the center of membrane before drilling, scale bar, 10 μm (b) Corresponding TEM image of the nanopore, scale bar, 20 nm. (c) The resulting PL map showing a trace followed the e-beam path. (d) Microscope image with three nanopore locations annotated, the e-beam was successively moved to the next position after the prior nanopore was created, scale bar, 10 μm. (e) Corresponding nanopores TEM images, scale bars, 20 nm. (f) The resulting PL map which shows clear traces. PL scanning was performed at laser power 1 mW, integration time 2 ms, scanning step 300 nm.

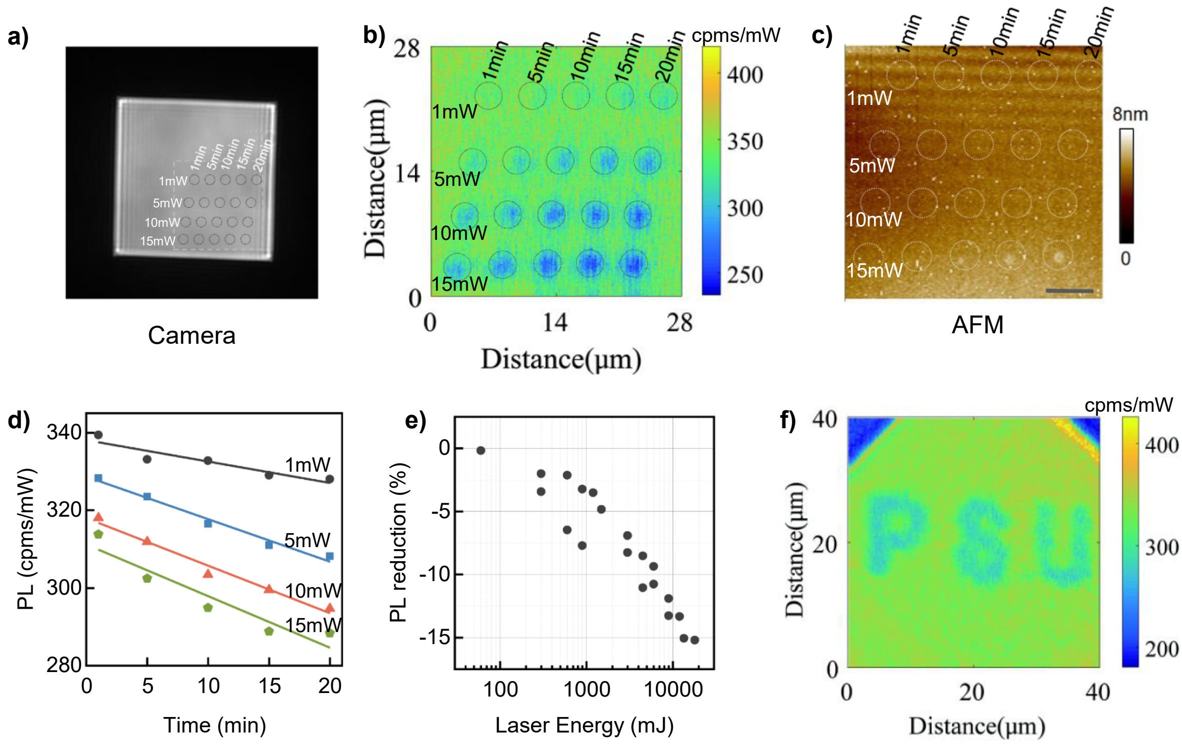

Figure 6. (a) Image of the SiN_x membrane showing the locations exposed to the focused 488 nm laser. (b) Resulting PL map after laser exposure (laser power, 1 mW, integration time, 2 ms, scanning step, 100 nm). (c) AFM image from the same sample, scale bar is 5 μm. The obvious morphology change (thickness increase) was observed at high laser powers. (d) PL reduction as a function of laser exposure time at various powers. Each data point was the average PL value of the laser exposed area (dashed circle in b). (e) PL reduction percentage as a function of cumulative laser energy. (f) PL map showing a laser-written pattern of letters 'PSU'.