Supplementary Information for

Rapid Prototyping of a Novel and Flexible Paper Based Oxygen Sensing Patch via Additive Inkjet Printing Process

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Fluorescence Lifetime Decay Mechanism:

Fluorescence lifetime is an intrinsic property of a fluorophore. When a light of particular wavelength region interacts with the outer electrons of ruthenium complex, the electrons excites from ground/low energy state to excited/high energy state (metal-to-ligand charge-transfer (MLCT) state). Typically, electrons are mostly stable at low energy states. When the electrons of a fluorophore like ruthenium are in high energy states, they emit fluorescence and physically interact or collide with oxygen molecules (oxygen is an effective collisional quencher/effective emission quenching or decaying agent). During this interaction/collision, the excited electrons transfers its excess energy to oxygen molecules and decays to low energy state. The time that the fluorophore electrons spends in the excited state before decaying to the ground state is called lifetime and the time required to decay 67% of the fluorescence emission is considered as fluorescence lifetime decay (Tau, τ). Higher the oxygen molecules, higher the number of collisions leading to more energy transfer between the fluorophore and oxygen, resulting in shorter decay time and vice-versa. A generic screen shot from the NeoFox Viewer Software showing the mechanism of fluorescence life time decay measurement is provided in Fig. S1.

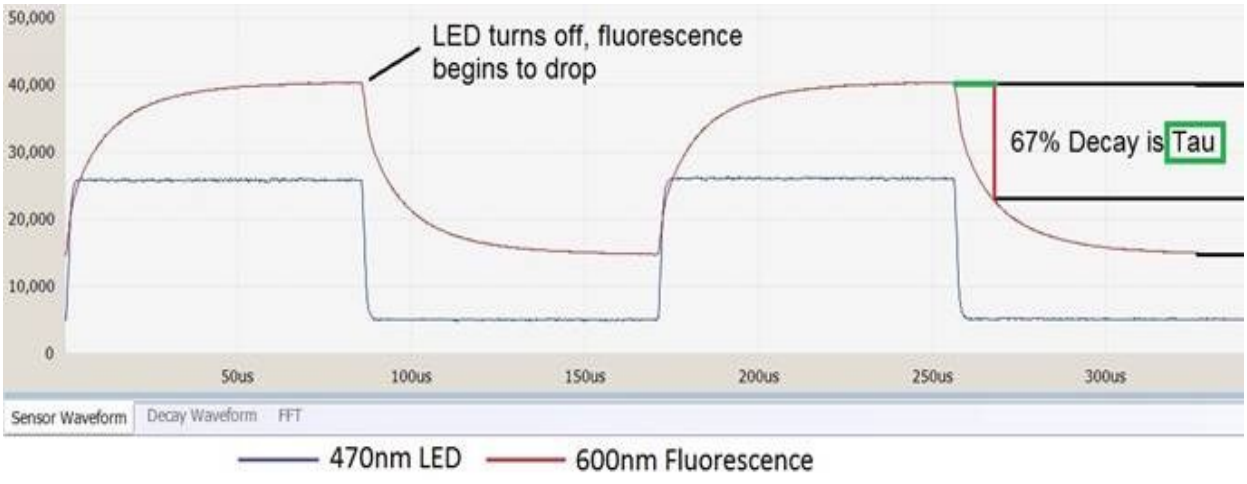

Figure S1. The mechanism of fluorescence lifetime decay measurement.

The NeoFox-GT fluorimeter consists of a blue LED (470 nm) and an avalanche photodiode that can absorb light at 600 nm. A bifurcated optical fiber probe (RE-BIFBORO-2) connected to the fluorimeter was placed at 2 mm distance from the oxygen sensor patch. The blue LED (470 nm) of fluorimeter flashes at 46.88 kHz in a square wave profile on oxygen sensor patch via the probe. When the LED is on, the ruthenium in the sensor patch gets excited and exhibits fluorescence broadly around 600 nm which will be absorbed by the photodiode in fluorimeter. When the LED is off, the fluorescence gets decayed/quenched and the fluorescence decay signals will be recorded as well as processed by NeoFox Viewer software to measure the time taken for decaying 67% of fluorescence value and to display the τ.