Optical Sensing of a Series of Tin Compounds with Amine Vapors

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1. Other tin compounds tested for emission with irradiation with 254 nm and 365 nm UV light.

Table SI1 Summary of tin compounds with and without room temperature emission.

Emitting	Non-Emitting	
$SnSO_4$	SnF_2	SnF_4
$Sn(CH_3SO_3)_2$	$SnCl_2$	
$Sn(CF_3SO_3)_2$	$SnBr_2$	$SnBr_4$
$SnFPO_3$	SnI_2	SnI_4
	SnO	SnO_2
	SnS	
	$Sn(CH_3COO)_2$	$Sn(CH_3COO)_4$
	$Sn(C_{32}H_{16}N_8)$	$Sn(C_{32}H_{16}N_8)Cl_2$
	SnP_2O_7	
	$Sn(O_2CC_{17}H_{35})_2$	

2. Effects of other vapors on the different tin(II) salts.

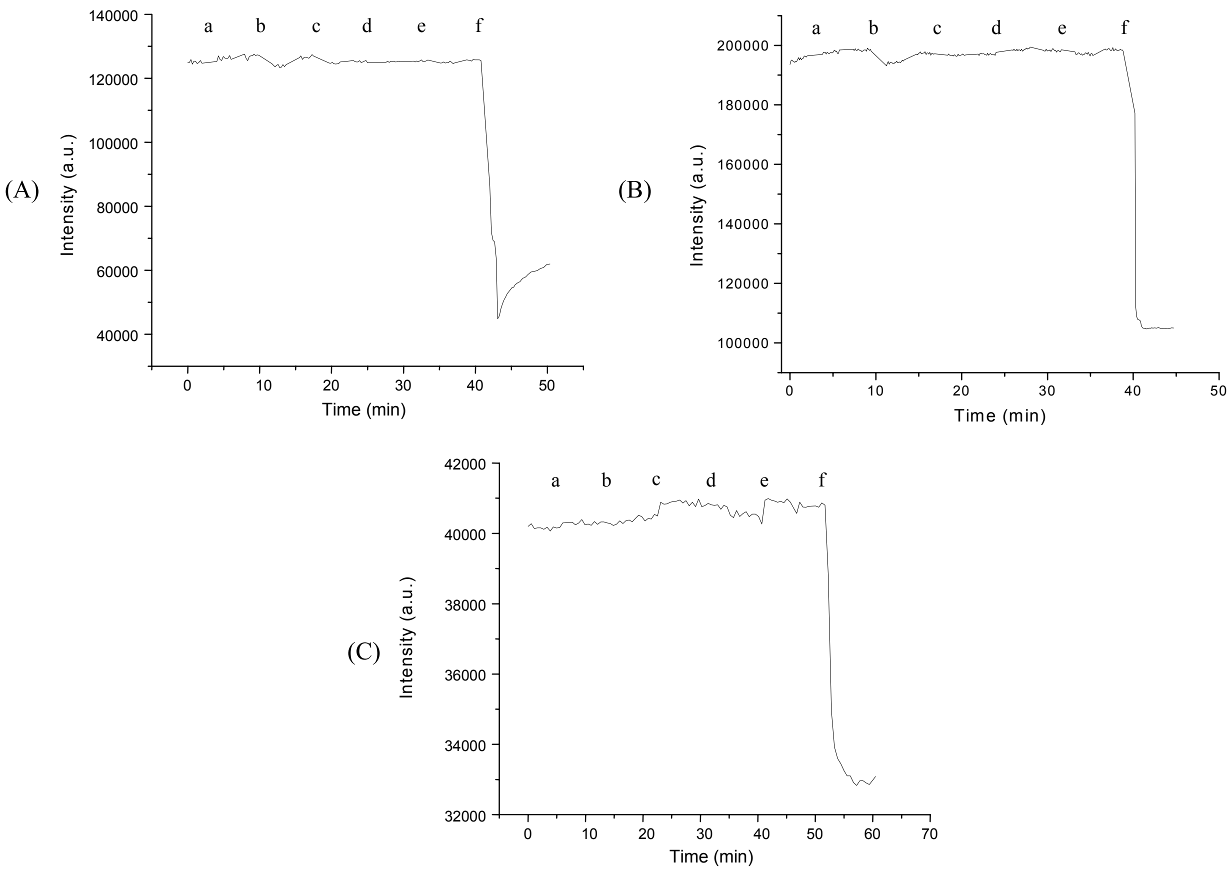


Figure SI2 Continuum exposure plots. a= dichloromethane, b= acetone, c= diethylether, d= pentane, e= ethanol, and f is a final amine, all 50 ppm concentrations. Plot A shows tin(II) methanesulfonate being quenched by 50 ppm pyridine [f], and plot B the same material except that the final amine, [f], is ammonia. Plot C is tin(II) sulfate and the final amine is 50 ppm triethylamine [f]. In each plot, the material is exposed to the analyte, held for 3-5 min and then purged with nitrogen for 3-5 min before the next analyte is introduced.

3. Exposure to tri-n-butylphosphine.

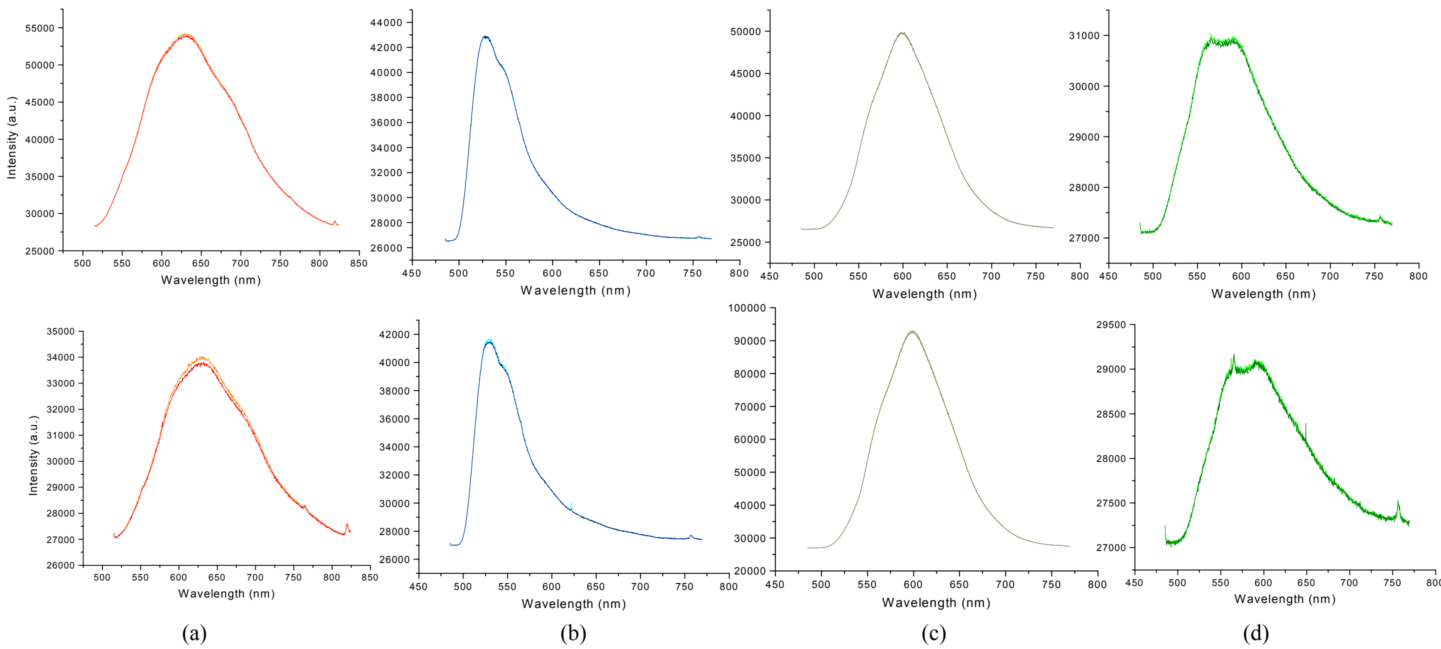


Figure SI3 Photoluminescence profiles of the four tin salts before and after exposure to 1 ppm (top) and 50 ppm (bottom) tri-n-butylphosphine. (a) $SnSO_4$ (b) $SnFPO_3$ (c) $Sn(CH_3SO_3)_2$ (d) $Sn(CF_3SO_3)_2$

4. Exposure to a 100 ppb concentration of pyridine.

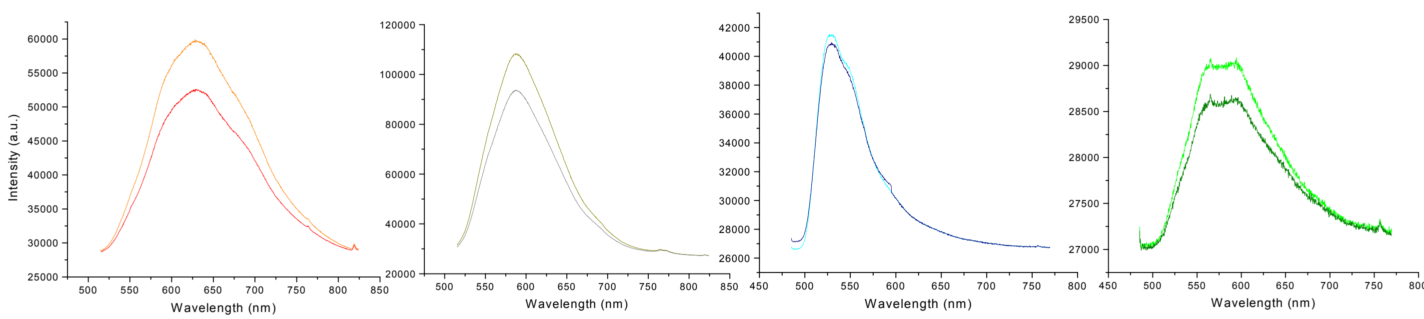
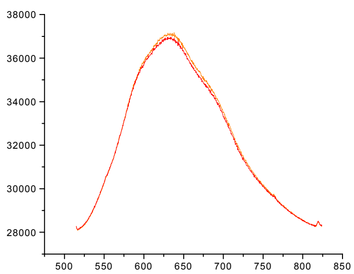


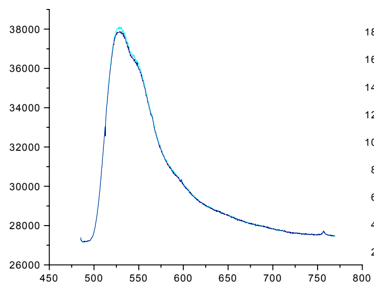
Figure SI4 Quenching with can occur at very low concentrations; here the array is exposed to 100 ppb pyridine.

5. Effect of humidity on the four tin(II) salts.

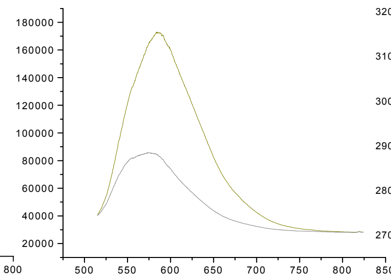
(a)



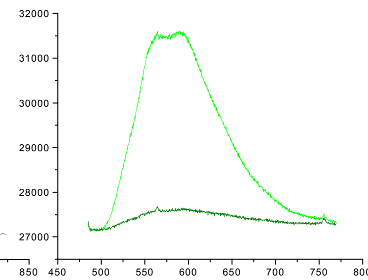
(b)



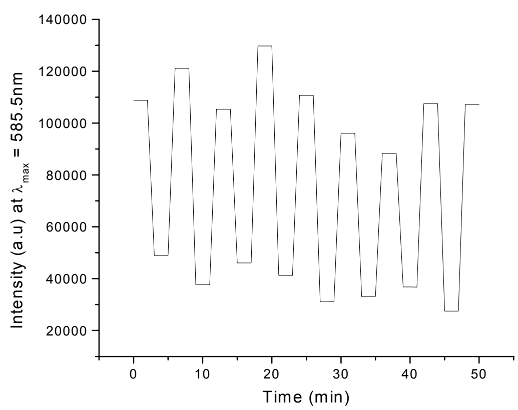
(c)



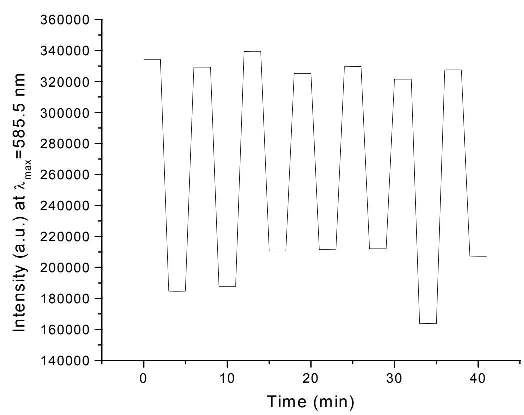
(d)



(e)



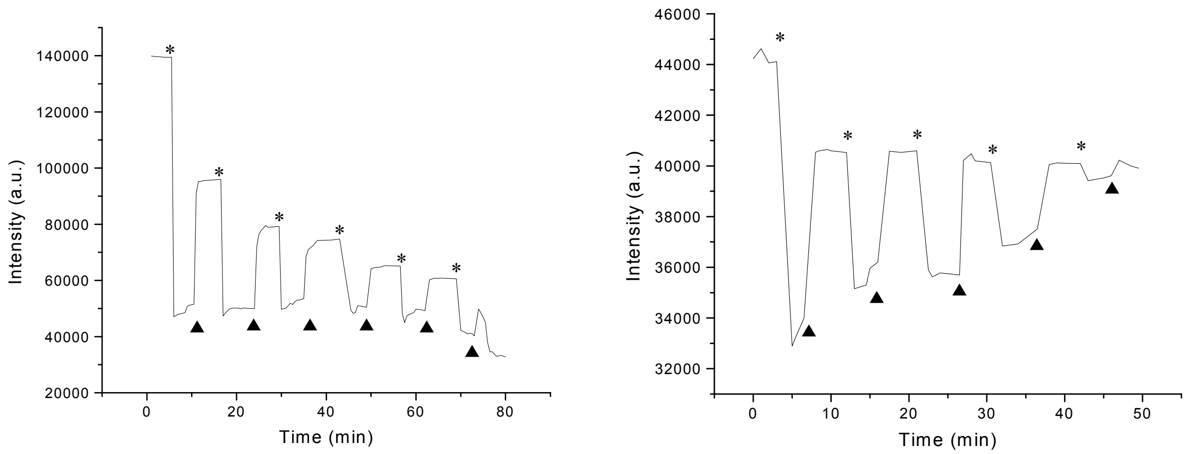
(f)



(g)

Figure SI5 (a) Effects of 40% humidity on the sensing array (left to right: $SnSO_4$, $SnFPO_3$, $Sn(CH_3SO_3)_2$, $Sn(CF_3SO_3)_2$). While $SnSO_4$ (b) and $SnFPO_3$ (c) PL remains unaffected, $Sn(CH_3SO_3)_2$ (d) and $Sn(CF_3SO_3)_2$ (e) emission is altered. Photoluminescence from $Sn(CH_3SO_3)_2$ and $Sn(CF_3SO_3)_2$ can be regenerated by heating at 100°C for 5 minutes and 20 minutes respectively. Cycling at 40% humidity (f) and 80% humidity (g) with $Sn(CH_3SO_3)_2$ reveals a highly reusable method of detection. Here the system was exposed to humidity, held steady for three min., heated for 5 min., and held again for 3 min before the next humidity exposure.

6. Regneration of $Sn(CH_3SO_3)_2$ and $SnSO_4$ with TFA vapors.



(a) (b)

Figure SI6 While TFA does induce some photoluminescence restoration, intensity never reaches the initial levels. $Sn(CH_3SO_3)_2$ (a) and $SnSO_4$ (b) are exposed to 20 ppm pyridine (*) for 2 minutes followed by a nitrogen purge for ~3 minutes, and then TFA was introduced (▲) for 2 minutes and held for another ~3 minutes followed also by a nitrogen purge. In the final cycle, the sample has become completely saturated.

7. Reversibility of Tin(II) fluorophosphate with nitrogen after exposure to 1ppm of pyridine.

(a)

(b)

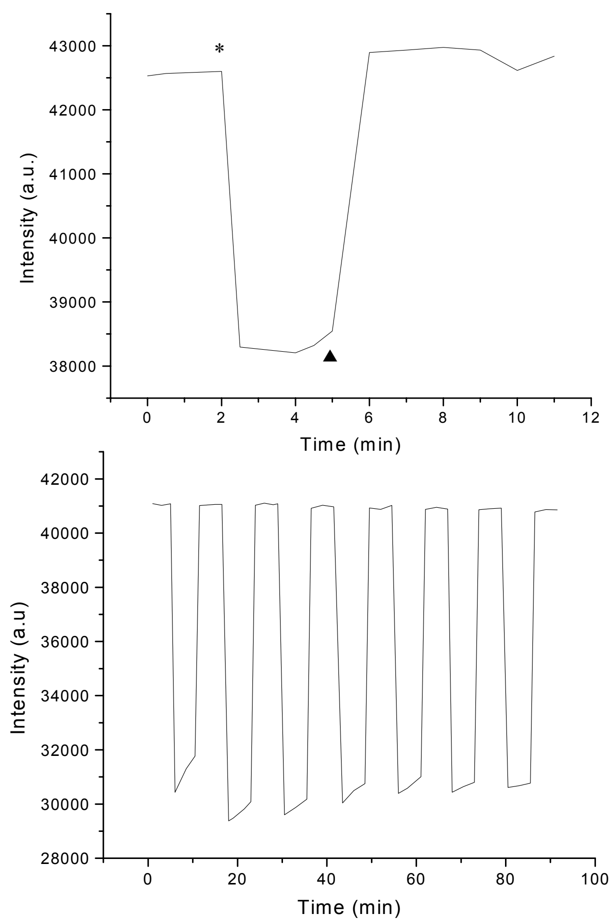
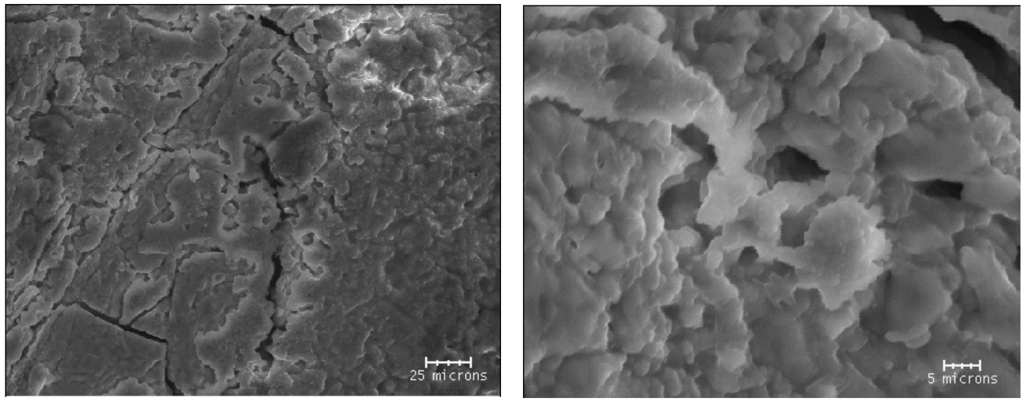


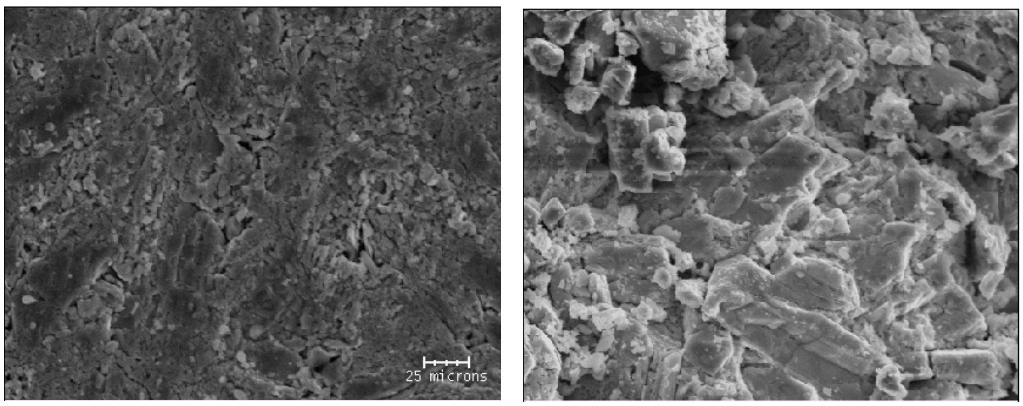
Figure SI7 Quenched light emission from $SnFPO_5$ can be quickly regenerated with a nitrogen flush. (a) Restoration after an exposure to 1 ppm pyridine. (b) Repeated cycling occurs after exposure to 100 ppm pyridine; the system was held under pyridine atmosphere (*) for 5 minutes before a 5 minute nitrogen purge (▲).

8. SEM images of the four tin salt pellets.

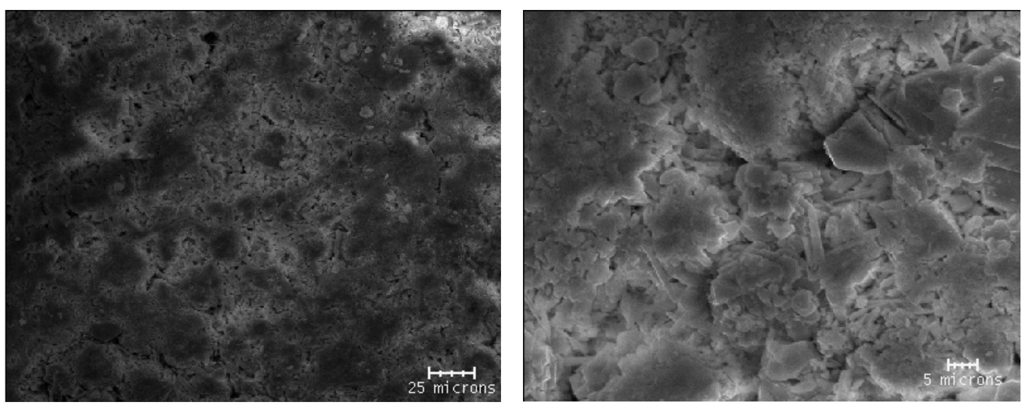
$SnSO_4$



$SnFPO_3$



$Sn(CH_3SO_3)_2$



$Sn(CF_3SO_3)_2$

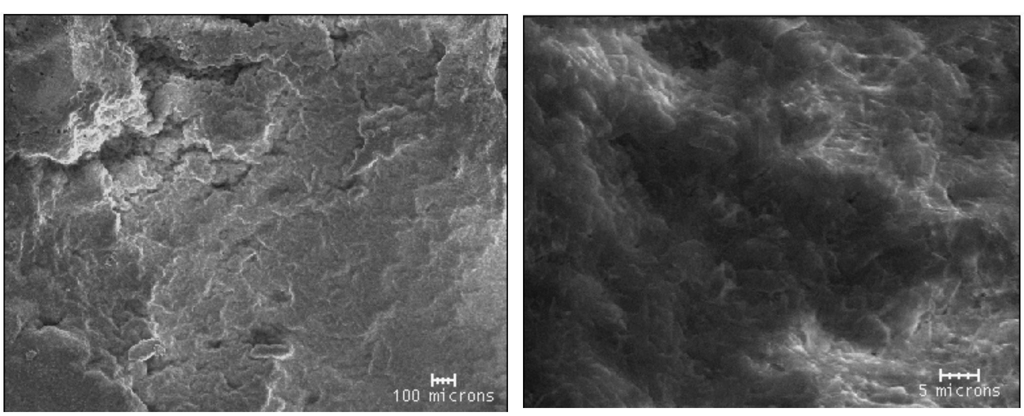


Figure SI8 Comparison of the surface features of each pellet, showing the rough and expected high surface area morphology for these pressed powders.