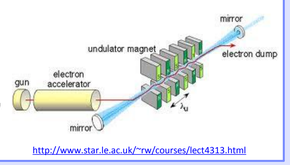
Rejuvenation of a Cesium-Based Dispenser Photocathode in Response to Atmospheric Contamination

Alexandra Day, Dr. Eric Montgomery, Dr. Kevin Jensen, Blake Riddick, Saara Khan, Scott Eustice

TREND 2012
Training and Research Experiences in Nonlinear Dynamics

Motivation

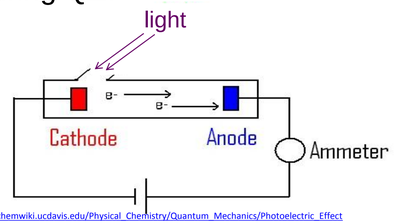
- Tunable wavelength
- High average power
- Applications: defense, medicine, research



http://www.star.le.ac.uk/~rw/courses/lect4313.html

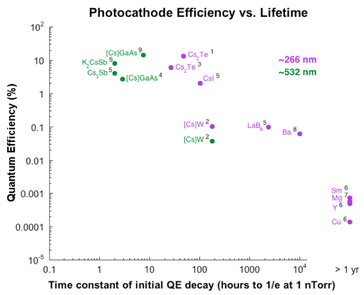
Quantum Efficiency

- Quantum Efficiency = $\frac{\text{Photons Out}}{\text{Electrons In}} = \frac{hc\ i}{q\lambda\ p_\lambda}$
- Measuring QE:

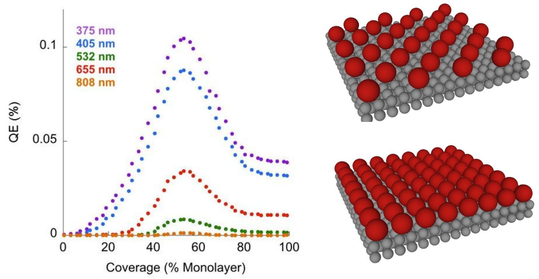


http://chemwiki.ucdavis.edu/Physical_Chemistry/Quantum_Mechanics/Photoelectric_Effect

- QE vs. Lifetime:

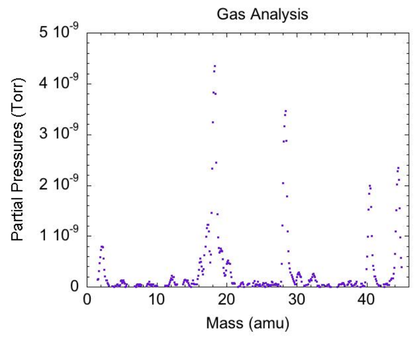


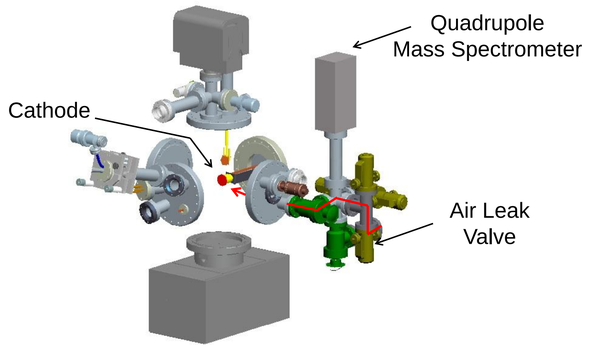
- Percent Monolayer Coverage:



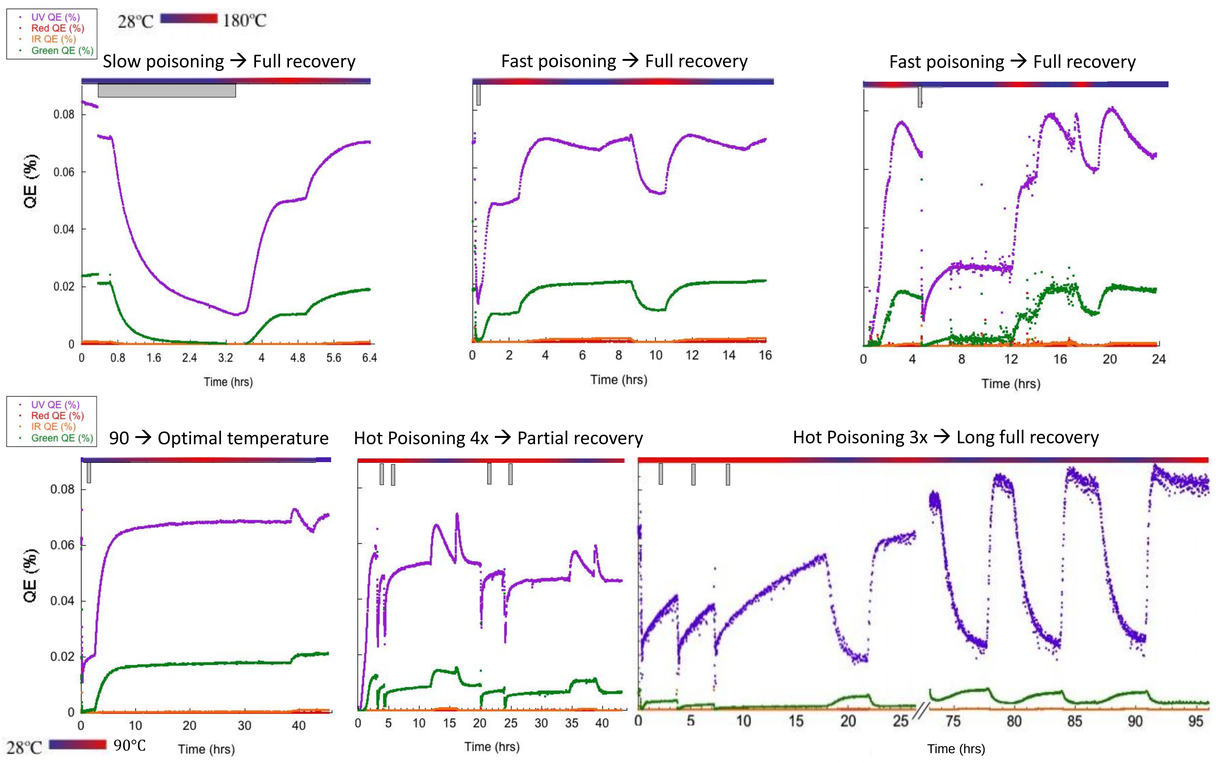
Atmospheric Contamination

Cs + contaminants → higher work function, lower QE → potential FEL failure

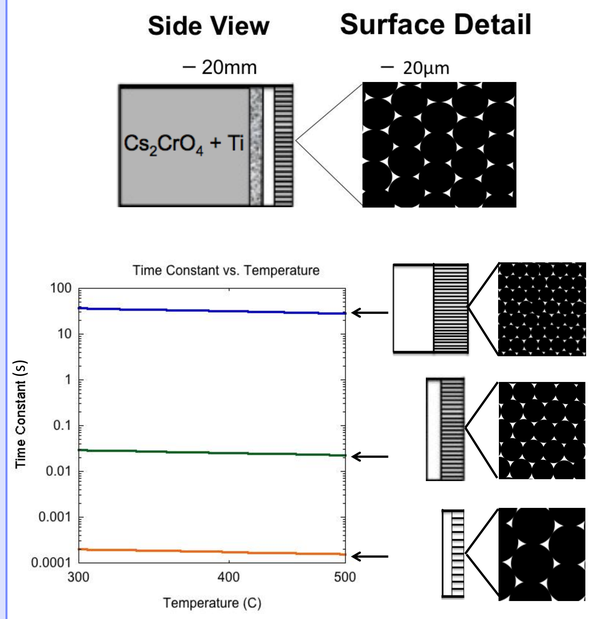




Results



Hybrid Dispenser



Key Conclusions

- Complete QE recovery from poisoning
- Can surpass initial QE value
- Ideal temperature determined by heating and cooling cycles: ≥90ºC
- Can recover QE from hot contamination
- First demonstration of a self-healing controlled porosity reservoir photocathode

Future Work

- Higher QE → cesium antimonide/auride
- Effects of cesium submonolayer evaporation into FEL photoinjector