# Synthesis of Luminescent Hybrid Materials


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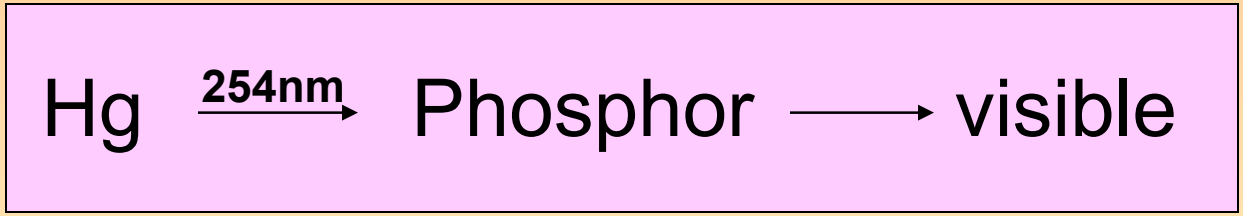
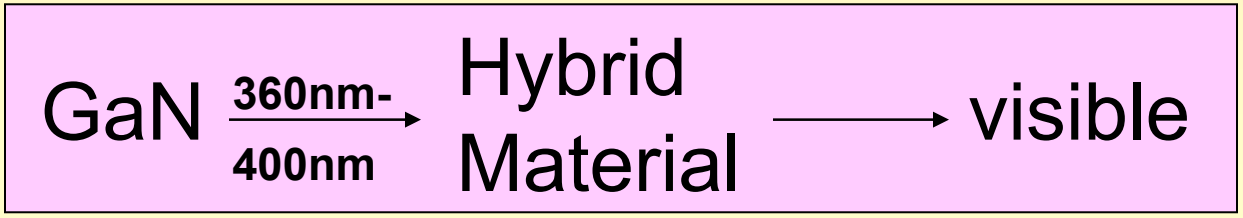
# REASON FOR THE RESEARCH

- Hg-based fluorescent lamps




Why change? Environmental pollution; Decrease power consumption; Longer life

- Future /Upcoming Tech GaN



## Objective:

- To Make Luminescent Inorganic-Organic Hybrid Materials

## Approach:

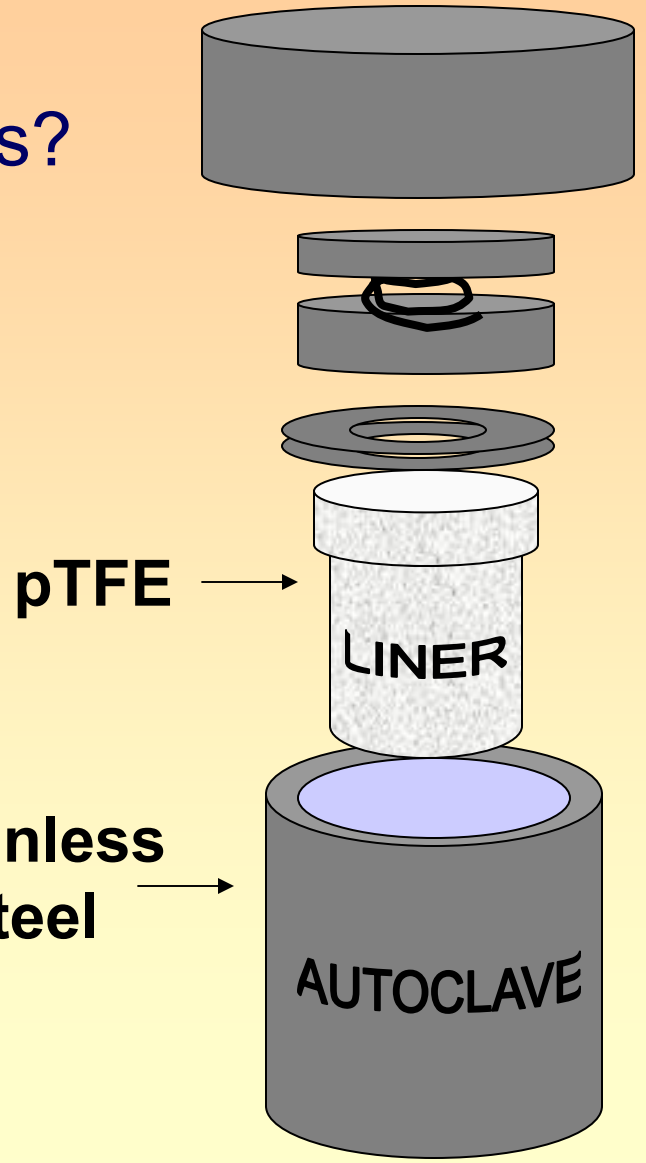
- Synthesis of materials containing lanthanide ions (La, Gd) by hydrothermal synthesis

- Studying luminescent properties of doped compounds

# HYDROTHERMAL SYNTHESIS

- What is Hydrothermal Synthesis?
  - **-Moderate Temperature**
  - **-Autogenous Pressure**

- PROCEDURE:
  - **-Combining reactants**
  - **-Autoclave**
  - **-Heat 200°C ~ 2,3 days**
  - **-Filter Material**

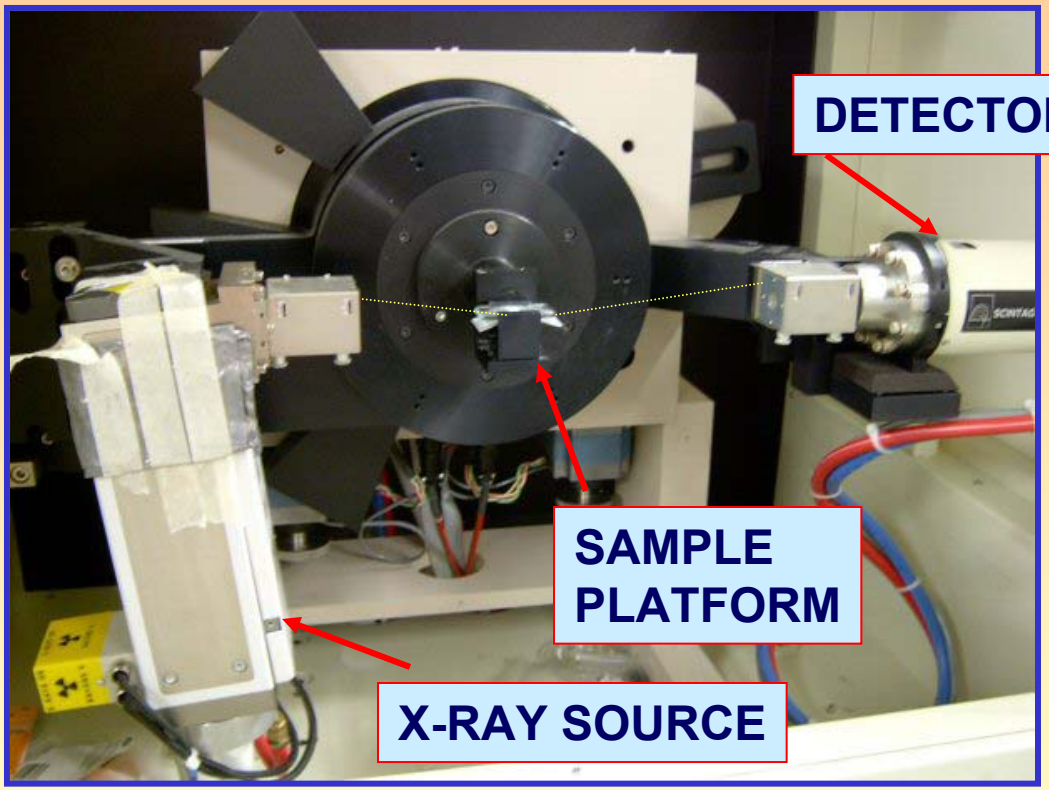


**Synthesized Samples:**

## Characterization:

- Single-crystal X-ray diffraction
- Powder X-ray diffraction
- Thermogravimetric Analysis
- Photoluminescence

# Powder X-ray diffraction

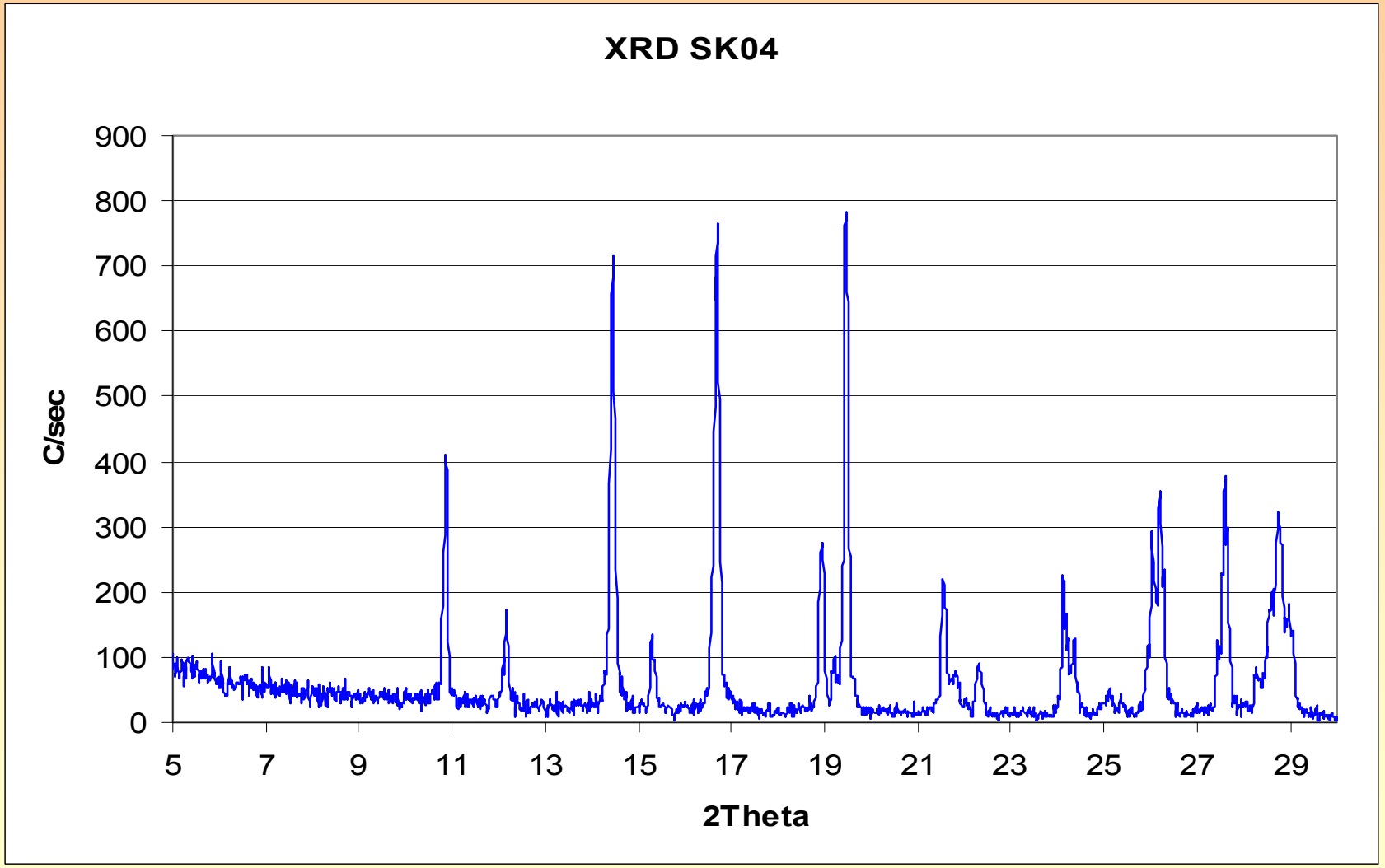



Bragg's Law:

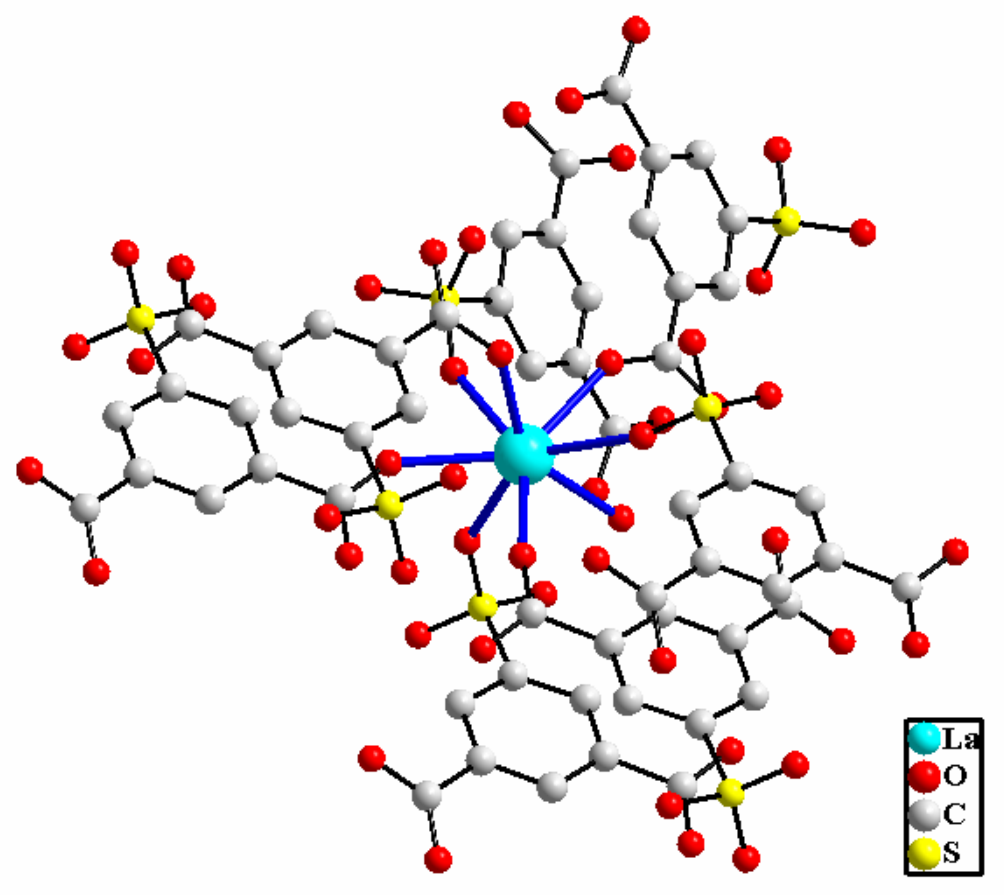
$$n\lambda=2d(\sin\theta)$$

- Cu source ($\lambda$ = 1.5418 Å)

# Powder XRD scan



# Single Crystal X-ray diffraction




**SK04**

**1mmol $La(NO_3)_3.6H_2O$ :**

**2mmol 5-sulfo-isophthalic acid**

**Water, NaOH**

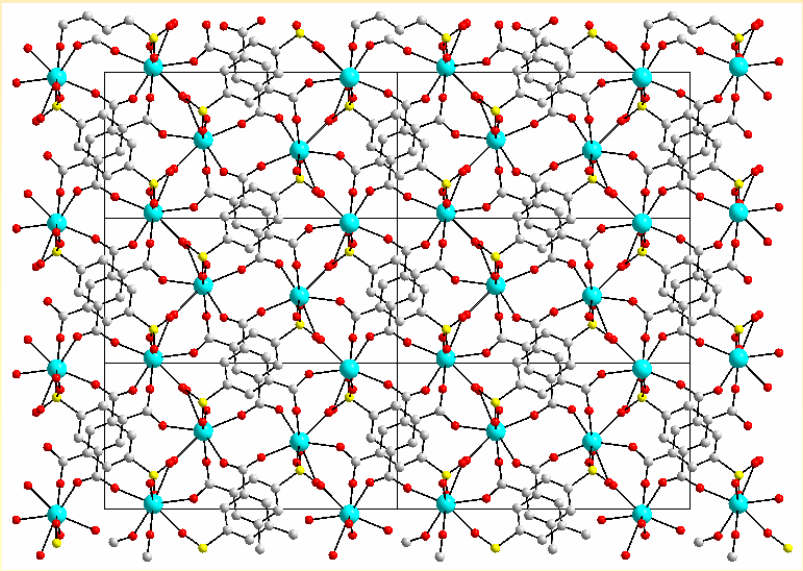
**T = 180°C/2days**

***a*** **= 7.1669(10) Å**

***b*** **= 8.3139(12) Å**

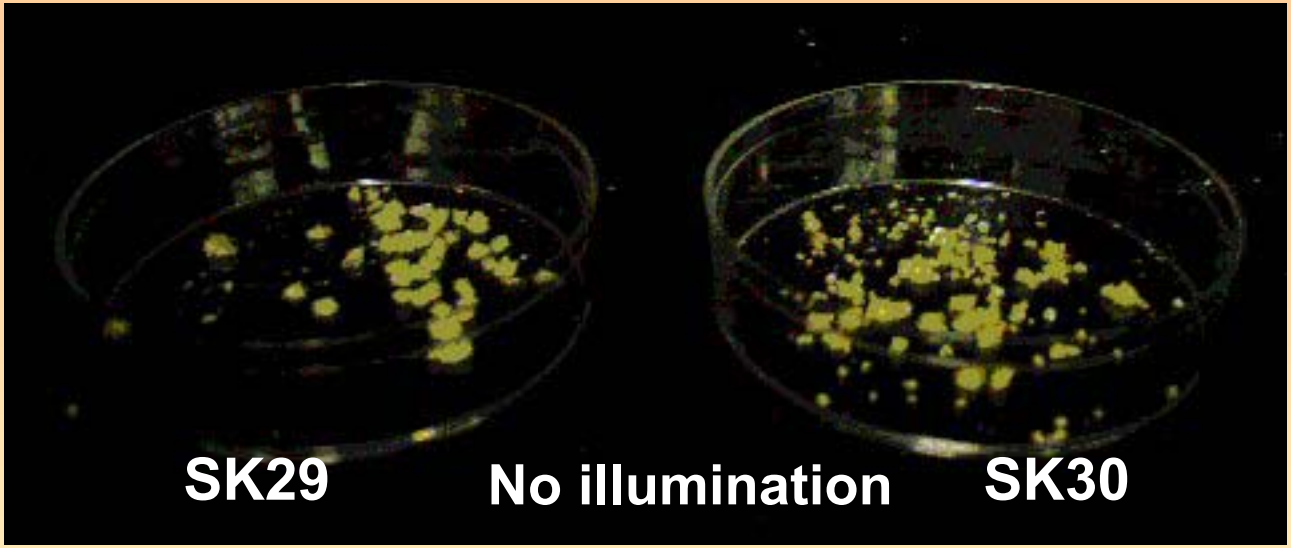
***c*** **= 16.8519(24) Å**

**β = 97.5 °**



- Mo source (λ = 0.71073Å)
- 0.1x 0.1 x 0.08mm

# LUMINESCENCE




.95mmol $La(NO_3)_3.6H_2O$ :

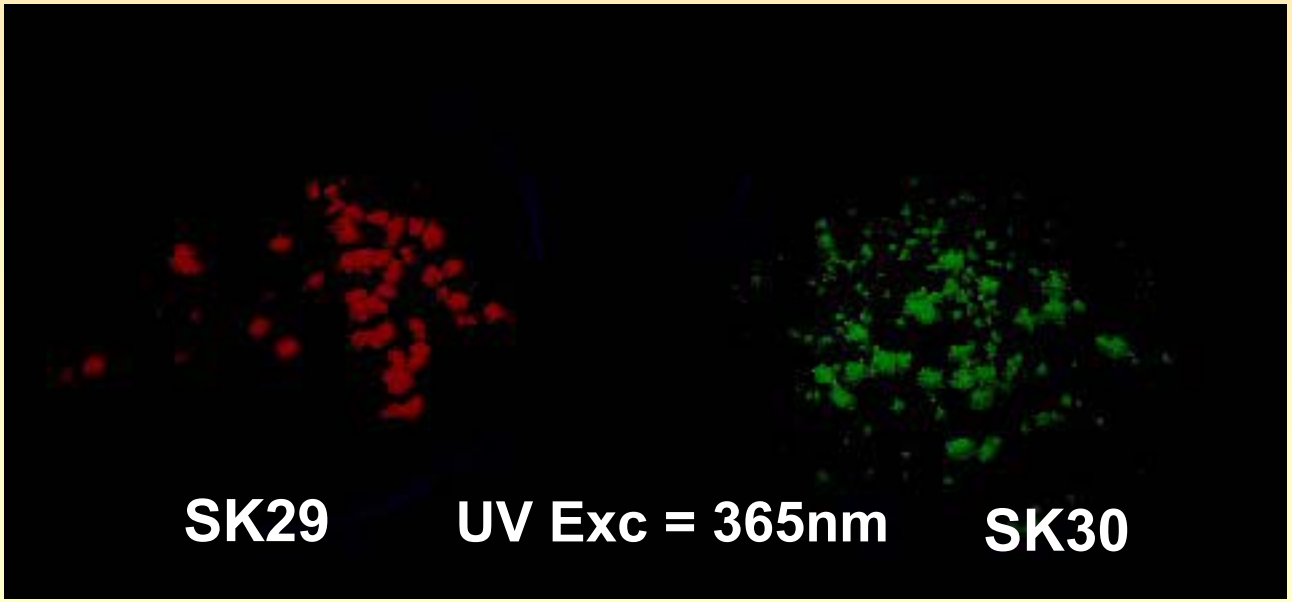
2mmol 5-sulfo-isophthalic acid

.05mmol Europium(II) nitrate pentahydrate (SK29)

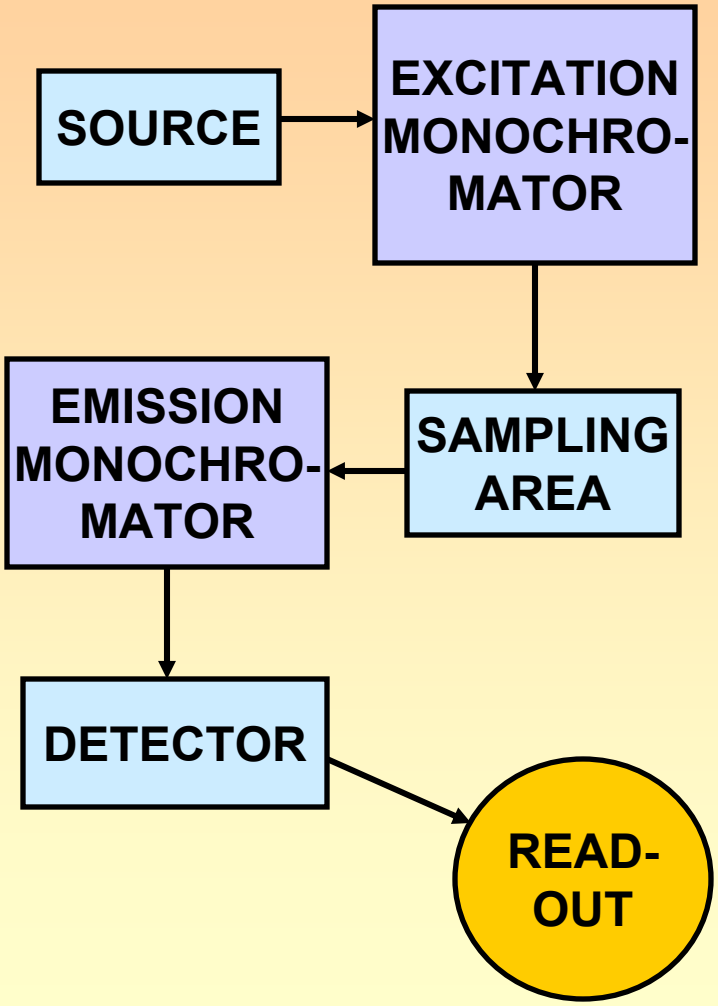
.05mmol Terbium(III) nitrate pentahydrate (SK30)

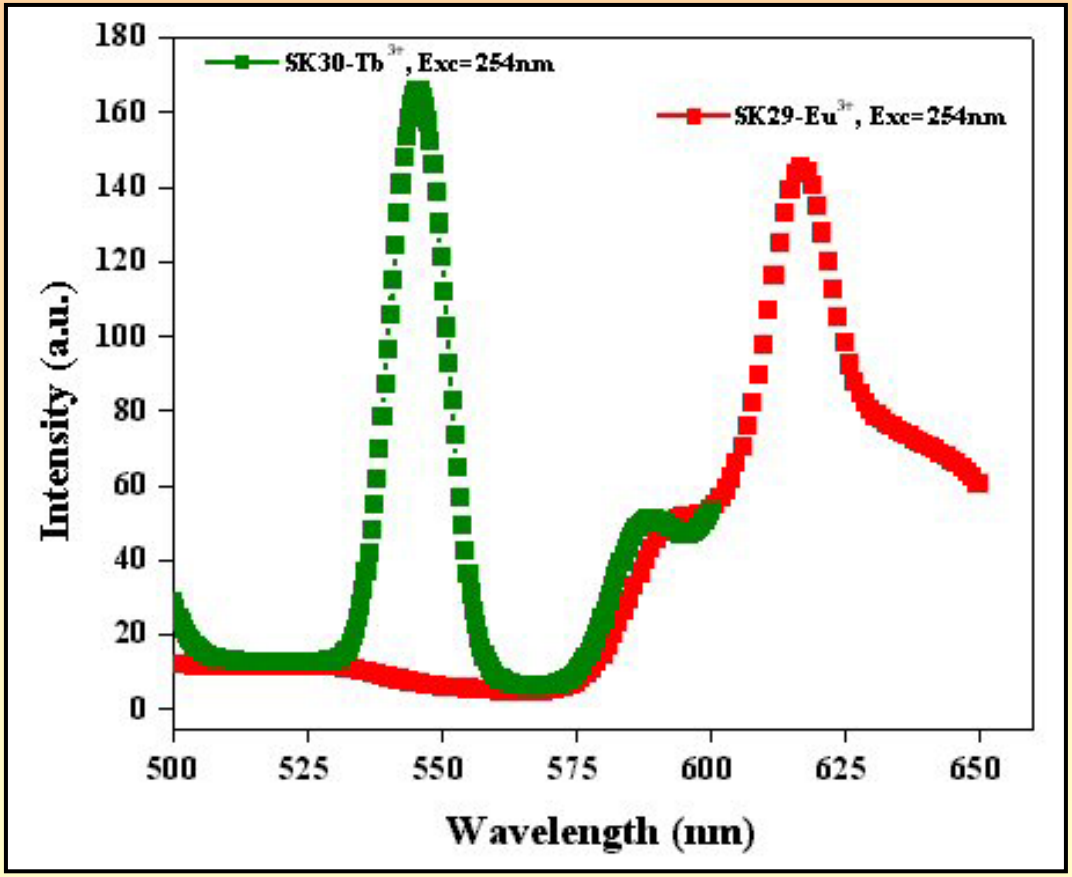
## Goal:

R(Eu) + G(Tb) + B(Ce) = White light



# Photoluminescence



## Achievements:

- Synthesized new hybrid materials
- Determined the single crystal structure of Lanthanum 5-sulfoisophthalate
- Studied the luminescent properties of Lanthanum 3,4-pyridinedicarboxylate doped with Eu and Tb.

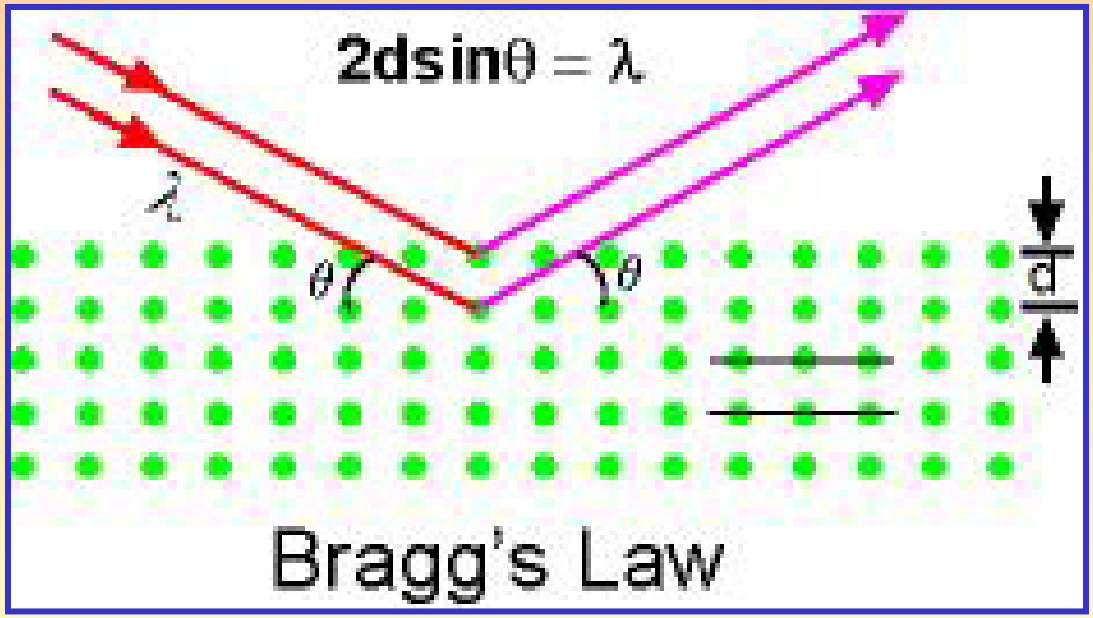
## Future plans:

- Study the structure and luminescent properties of other hybrid materials
- Explore the thermal properties of some of them
- Hopefully make the world glow through my materials

# Acknowledgements


- **INSET program** (Trevor Hirst, Nick Arnold, Mike Northen)
- **MRL** (Prof. Tony Cheetham, Neeraj Sharma, Grady Snyder)
- **Funding** (Mitsubishi Chemical Company, CNSI, NSF)

# Bragg's Law




θ – the scattering angle

**n** – an integer representing the order of the diffraction

**d -** distance

http://www.mrl.ucsb.edu/mrl/centralfacilities/xray/xray-basics/Xray-basics.html