

Copper-Based Superconductors

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What are Superconductors?

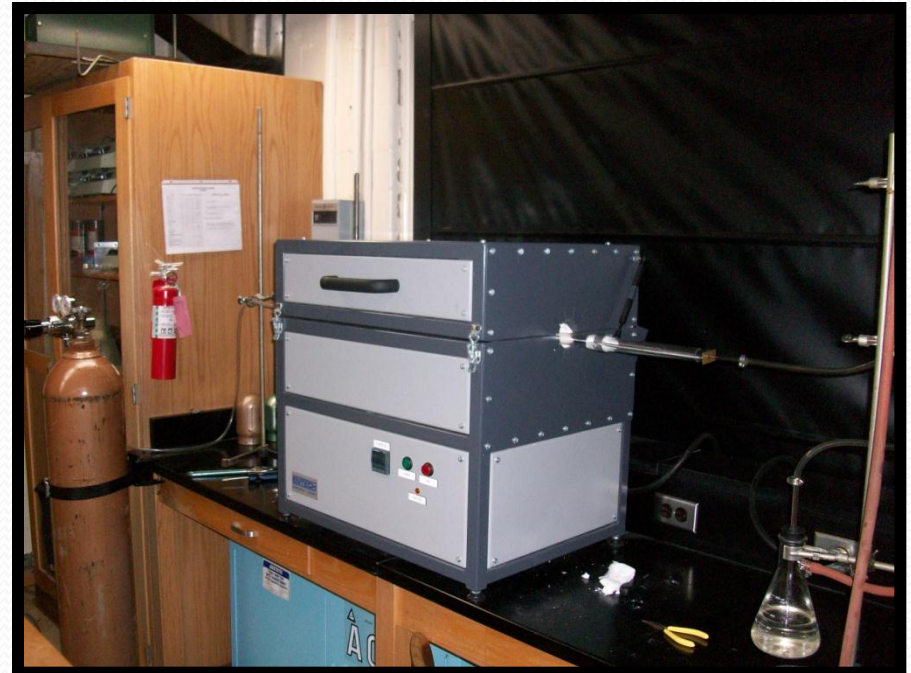
- **Superconductors** – conductors that allow current to flow without resistance in very low temperatures



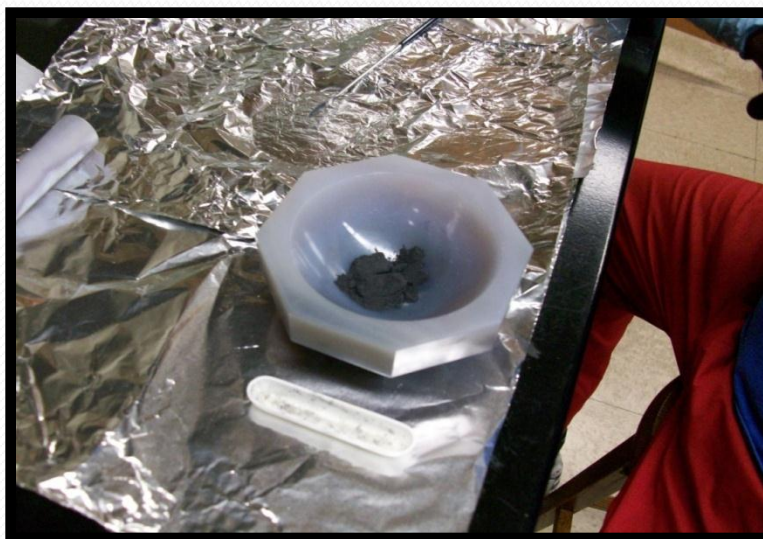
Magnetically Levitated Train

Research Goal

- **Synthesize Superconductors**
 - **Solid State Method**
 - **Heat Treatments**



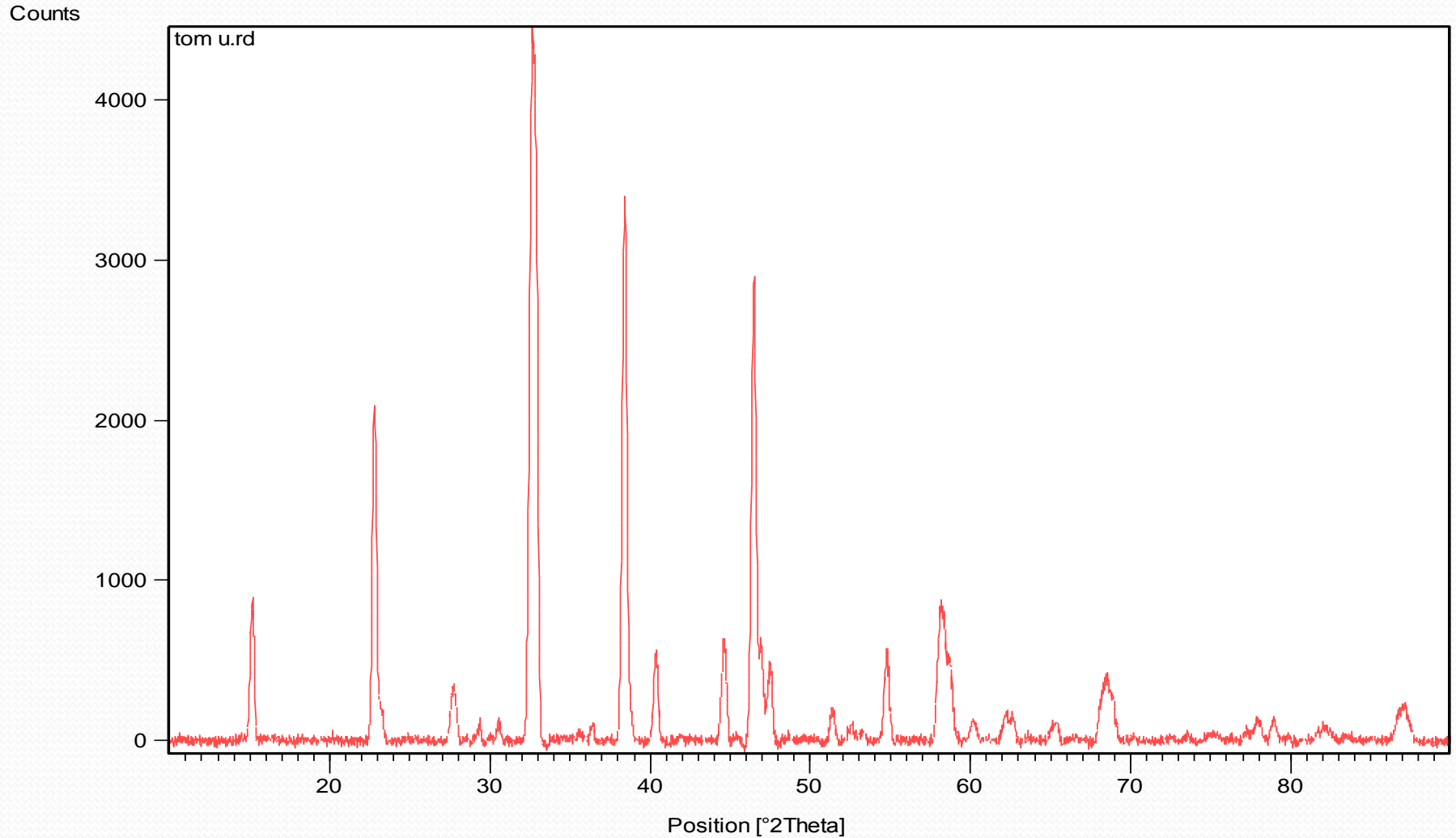
Picture of Oxides



Successfully Synthesized Compounds

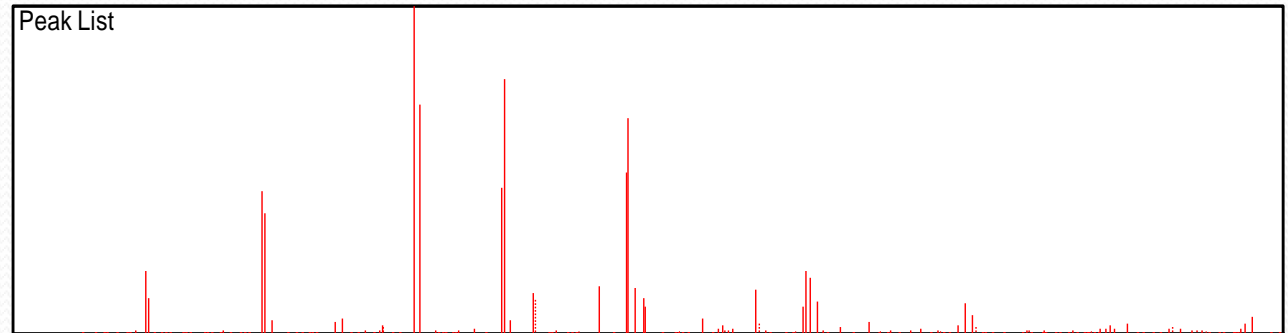
Compound	X-Ray Diffraction (Crystal Structure)	Preliminary Confirmation of Superconductivity (Meissner Effect)
$\text{Y}_1\text{Ba}_2\text{Cu}_3\text{O}_{6.59}$ (Y123)	Successfully synthesized	Successful **

X-ray Diffraction of Y123

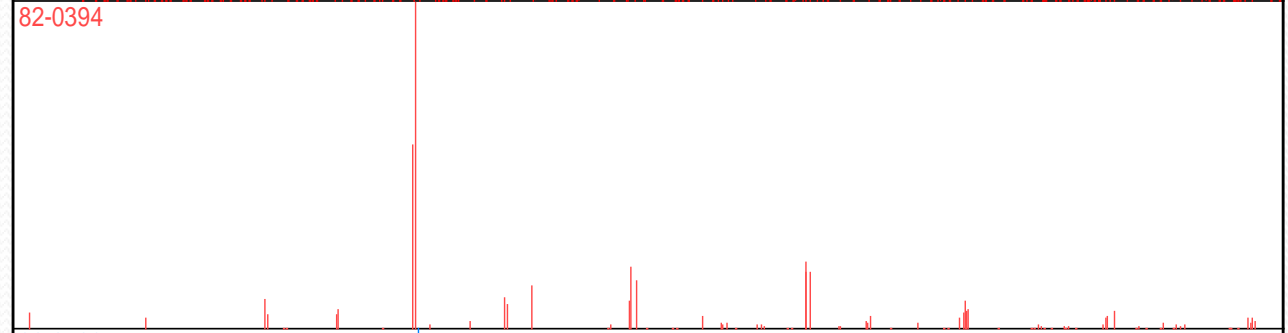


Pictures from the Database

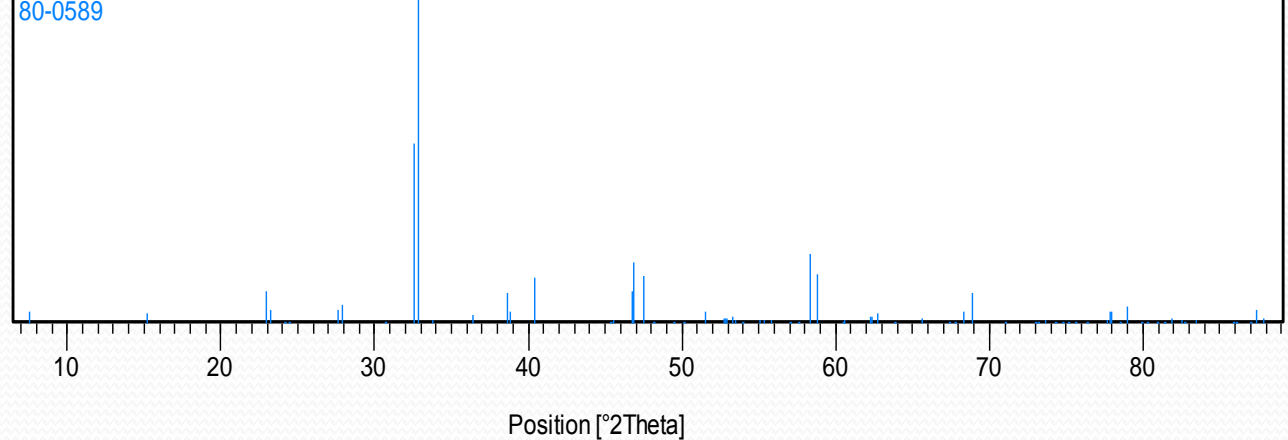
➤ This is the graph of my compound



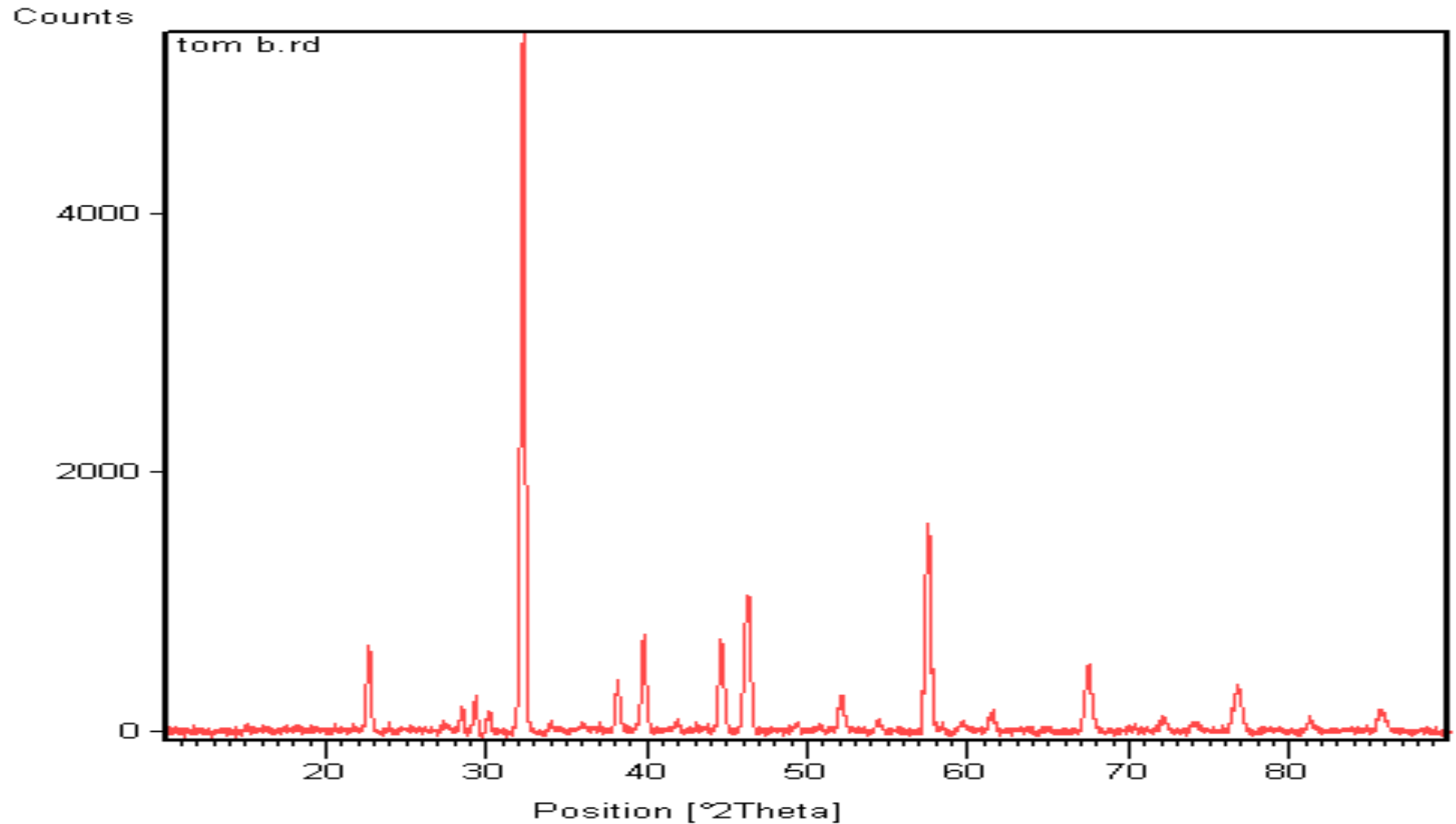
➤ $Y_1Ba_2Cu_3O_{6.59}$
- I wanted to make this compound



➤ $Y_1Ba_2Cu_3O_{6.63}$
- A Comparison



X-ray Diffraction of La123



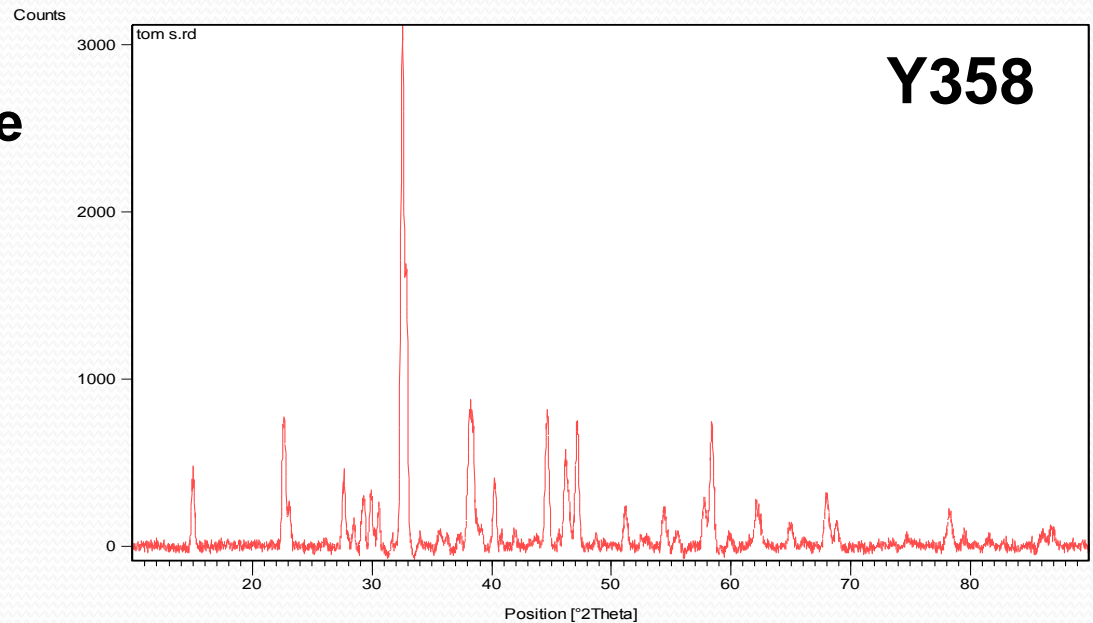
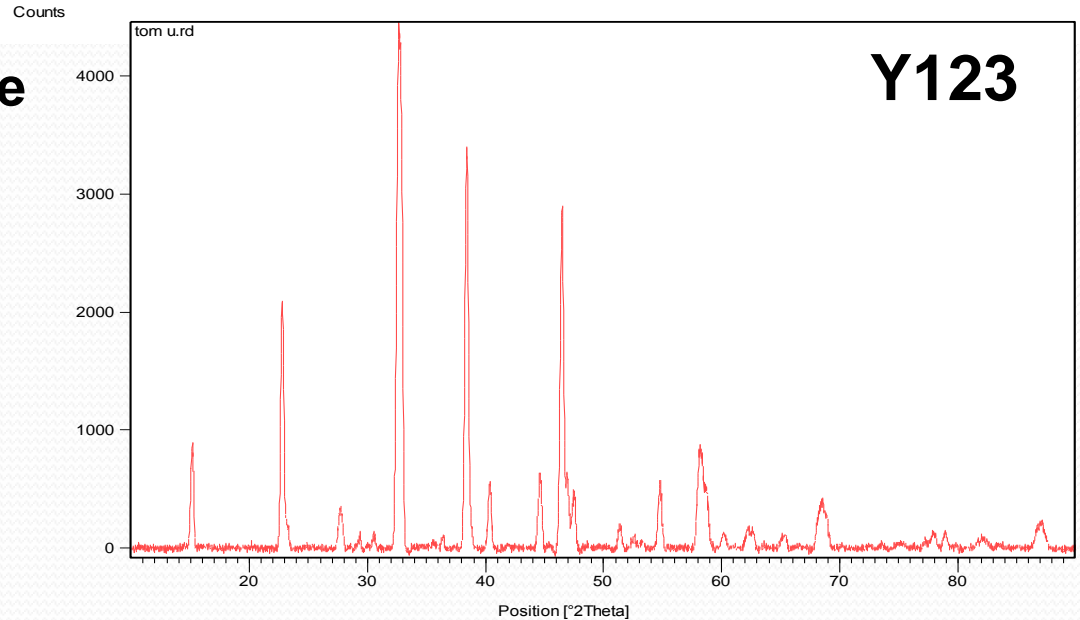
X-ray Diffraction of Y123 and Y358

➤ Attempted to synthesize
 $\text{YBa}_2\text{Cu}_3\text{O}_7$

➤ Database indicated
production of
 $\text{YBa}_2\text{Cu}_3\text{O}_{6.59}$

➤ Attempted to synthesize
 $\text{Y}_3\text{Ba}_5\text{Cu}_8\text{O}_7$

➤ Database indicated the
production of
 $\text{YBa}_2\text{Cu}_3\text{O}_{6.38}$



One Additional Successful Compound

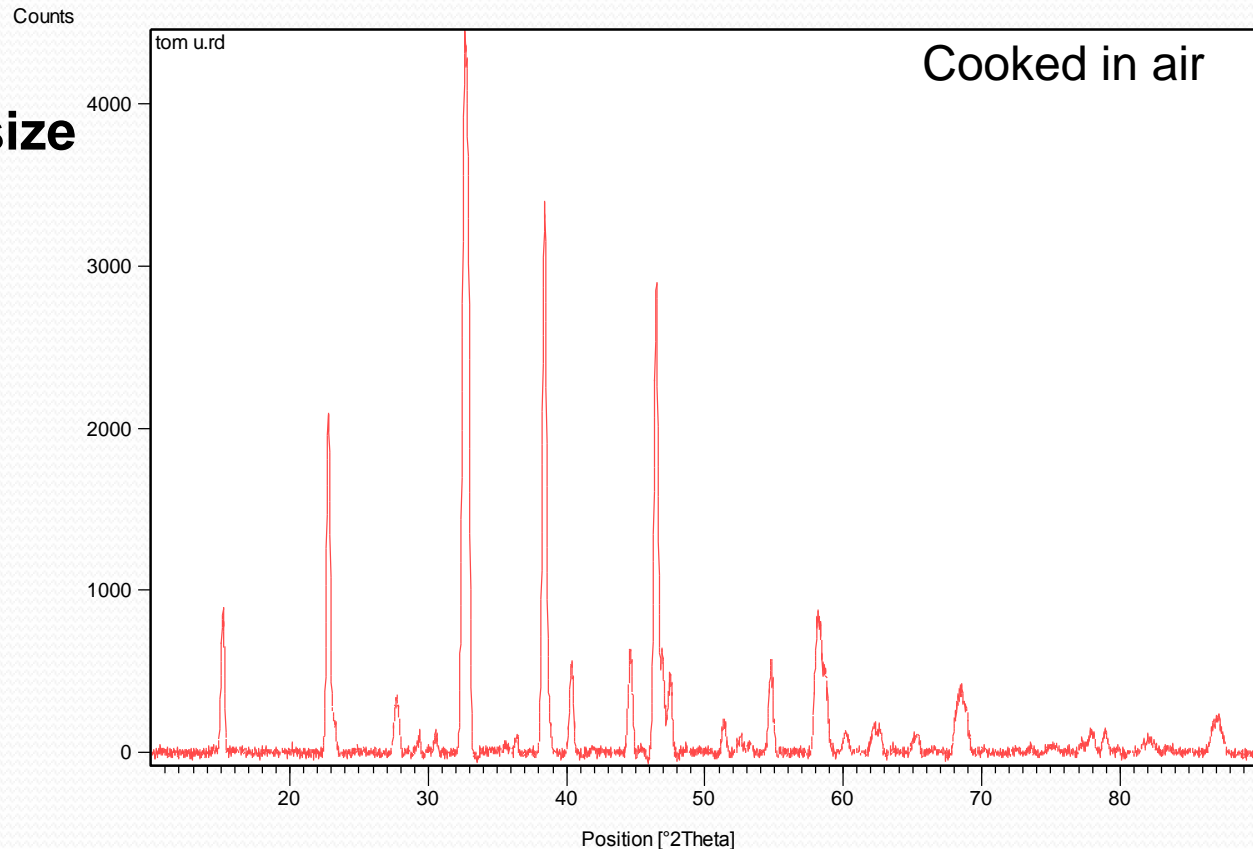
Compound	Preparation Conditions	X-Ray Diffraction (Crystal Structure)
$\text{Y}_1\text{Ba}_2\text{Cu}_3\text{O}_7$	<ol style="list-style-type: none"><li>1. Cooked in open air<li>2. Cooked under the flow of oxygen	Successful

X-ray Diffraction of $\text{YBa}_2\text{Cu}_3\text{O}_{6.59}$

➤ Attempted to synthesize



➤ Database indicated production of

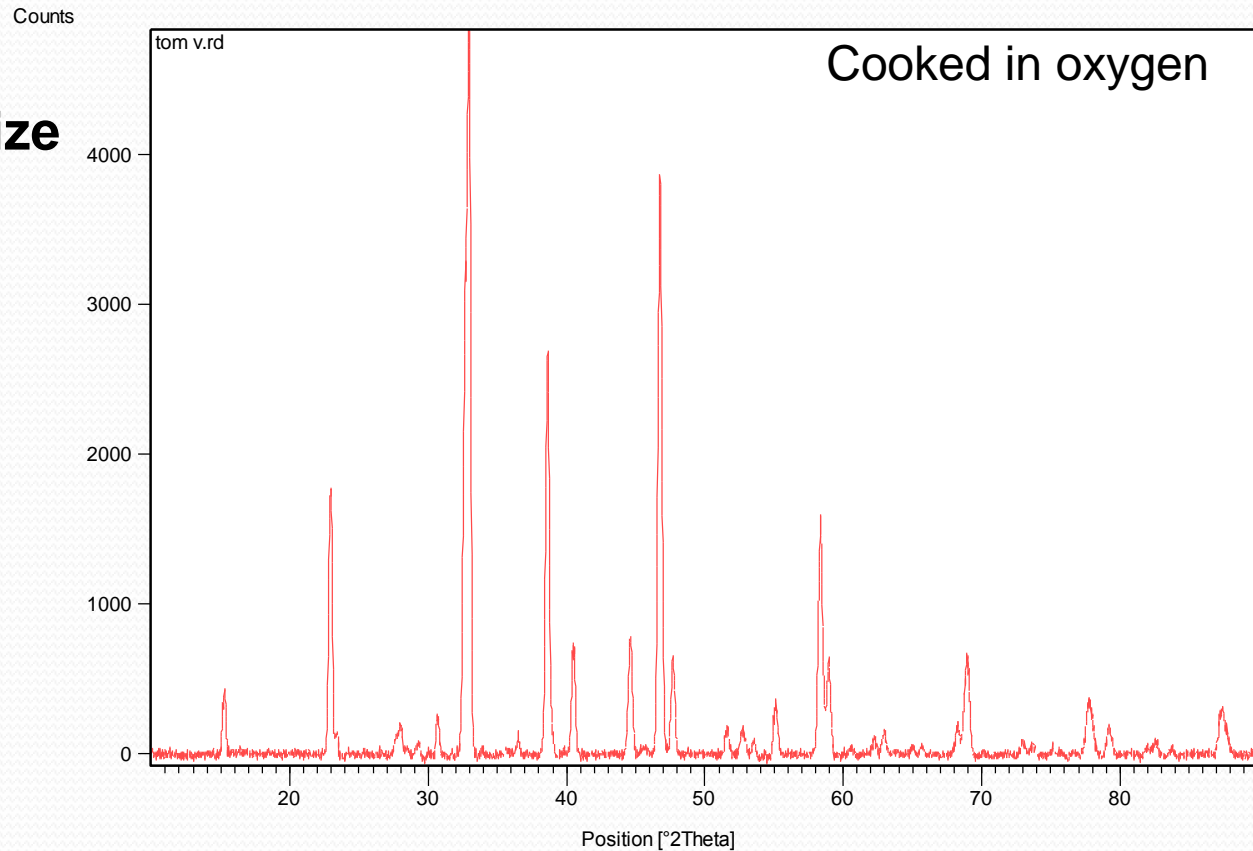


X-ray Diffraction of $Y_1Ba_2Cu_3O_7$

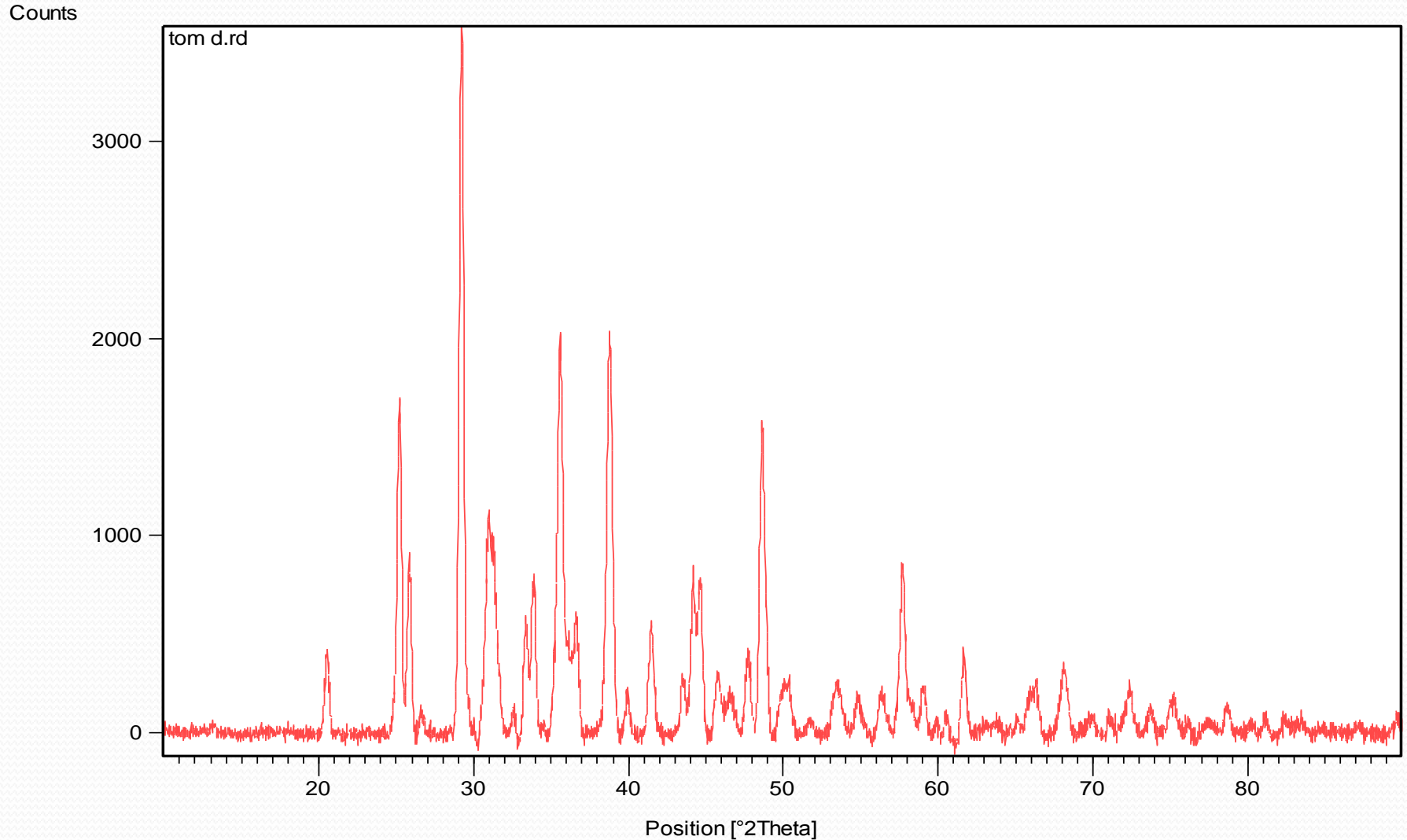
➤ Attempted to synthesize



➤ Database indicated production of



X-ray Diffraction of $\text{YSr}_2\text{Cu}_3\text{O}_{7 \pm \delta}$



Conclusions

- **Molecular ratios do not affect the crystal structure of a compound**
- **Superconductors oxygen content can be made full by cooking the compound under oxygen**
- **Some superconductors have certain conditions under which they must be synthesized**

Future Goals

- **Measure the Resistivity vs. Temperature of successfully synthesized Superconductors**
- **Synthesize Iron-Based Superconductors**

Acknowledgements

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