

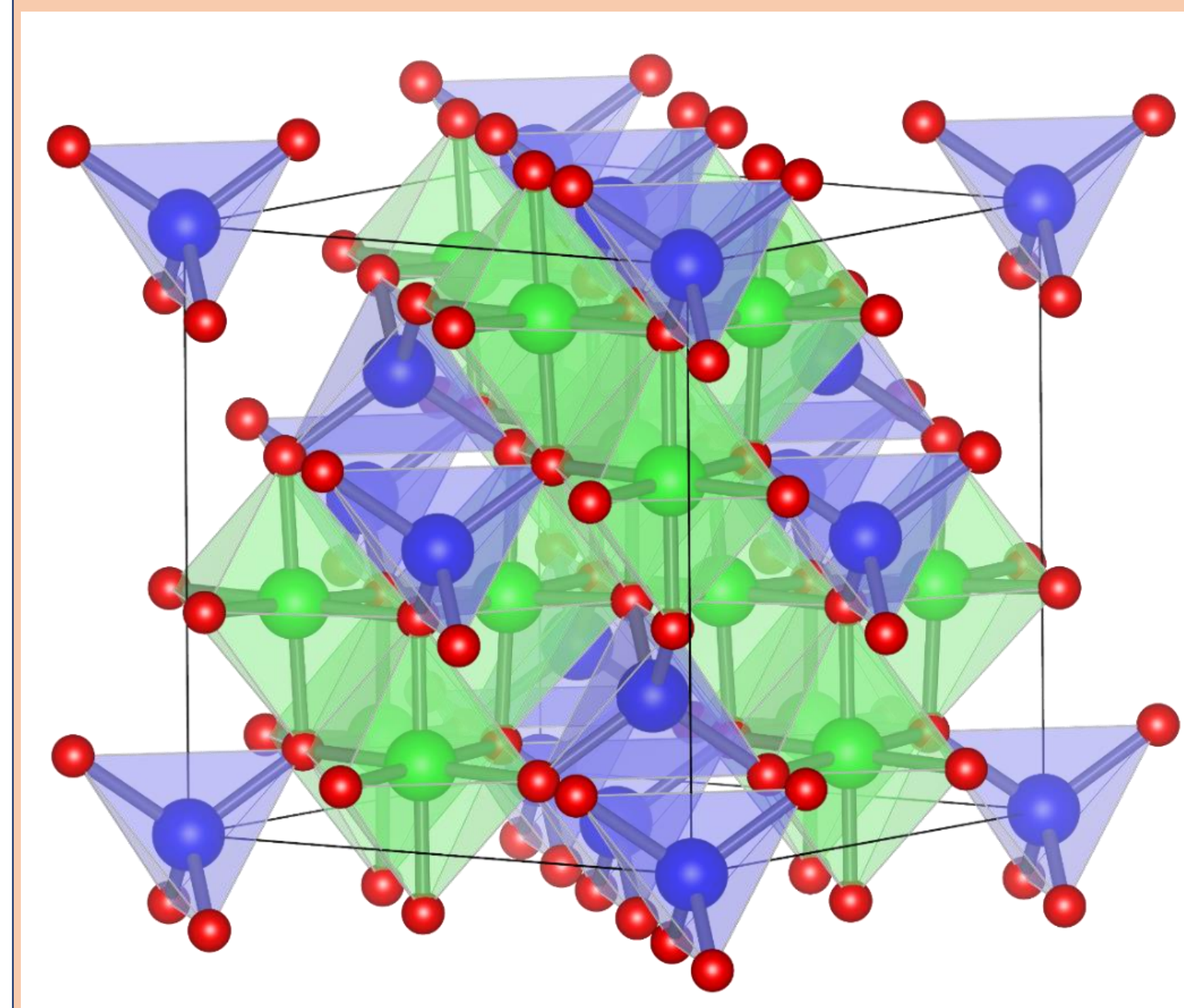
Magnetic Properties of Diluted Jahn-Teller Active Cuprospinel

Mouli Roy-Chowdhury*, Suchit Kumar Jena, Subhash Thota

Department of Physics, Indian Institute of Technology Guwahati, Assam 781039, India

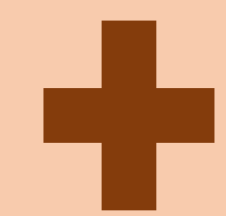
*Presenting author, email id: mouli.roy@iitg.ac.in

Copper Ferrite Spinel



- Typical Spinel structure stabilizes in $Fd-3m$
- Jahn-Teller distortion due to Jahn-Teller active Cu^{2+} ions
- CuFe_2O_4 stabilizes in $I41/amd$ crystal symmetry.

Substitution of Cu^{2+} ions with non-magnetic, JT inactive Zn^{2+} ions



Slight magnetic dilution at the Fe^{3+} sites by weakly magnetic Ru^{3+} ions

Methodology and Tools

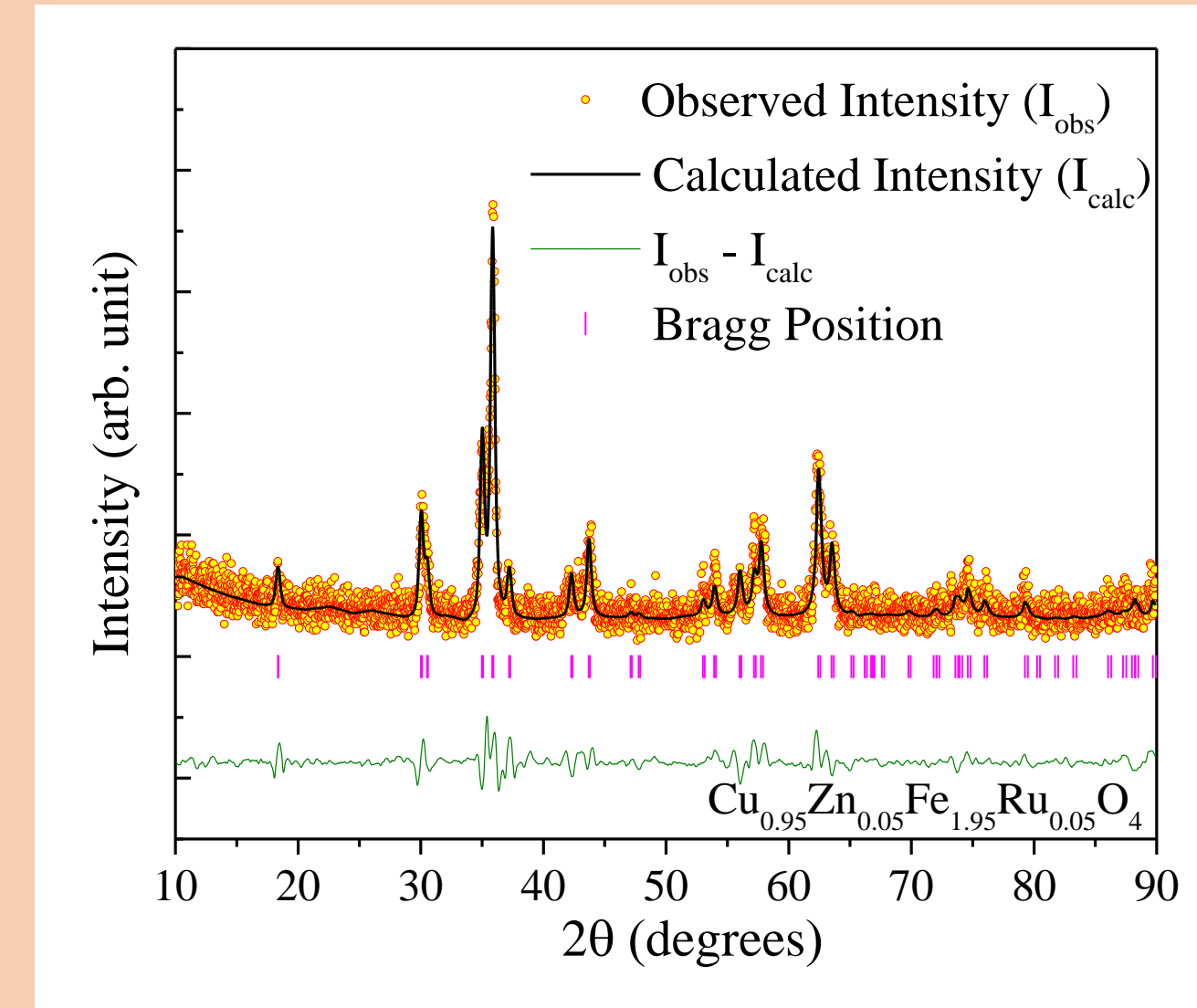
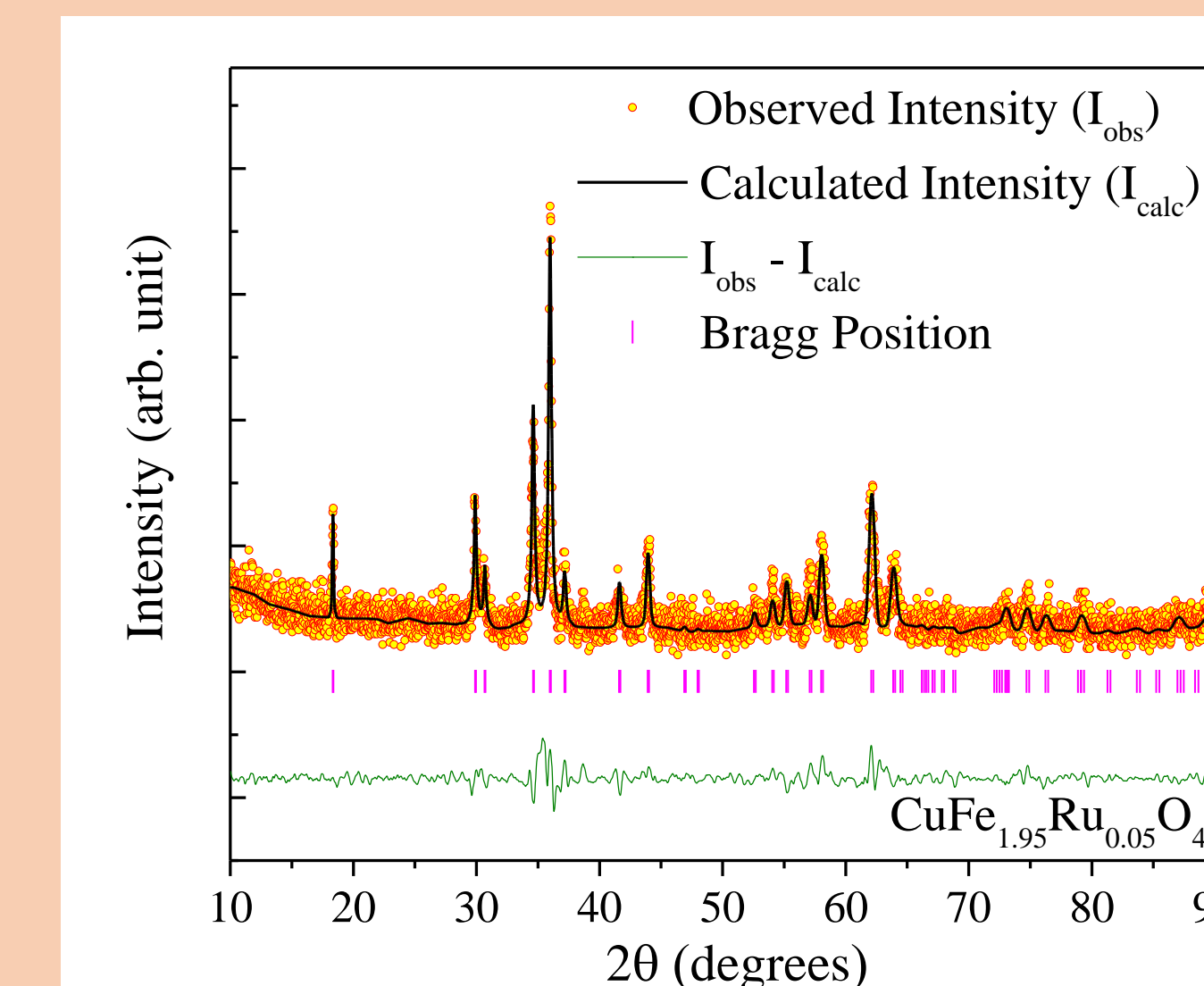
- Sample synthesis using **solid state reaction** method
- Room temperature **x-ray diffraction** for crystal structure and phase purity
- High Temperature Magnetic Measurements



Results and Discussion

Tetragonal or $I41/amd$

$x = 0$ and 0.05
✓ $a = b = 5.827 \text{ \AA}$ and $c = 8.668 \text{ \AA}$

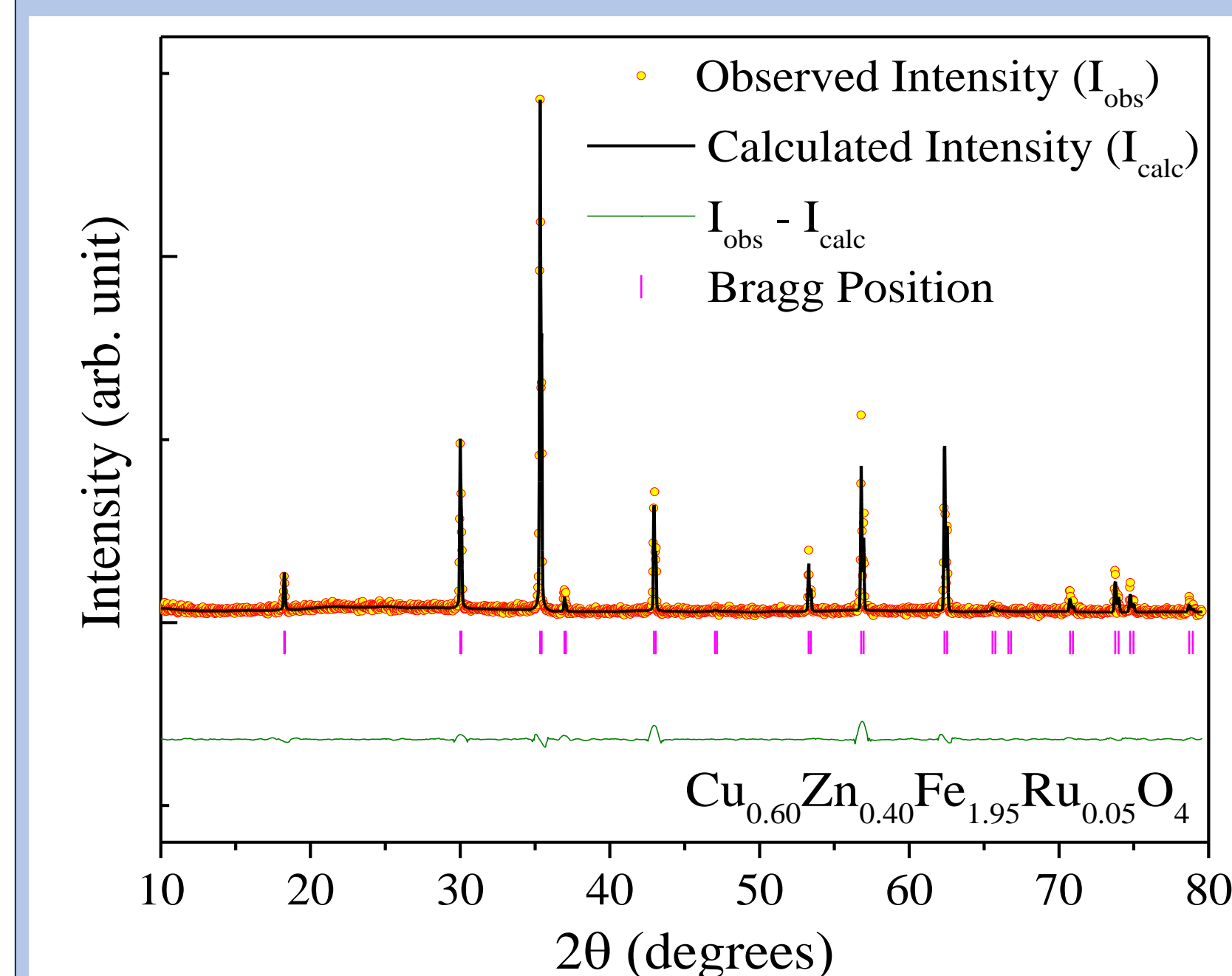


Results and Discussion

Cubic or $Fd-3m$

$x = 0.4$

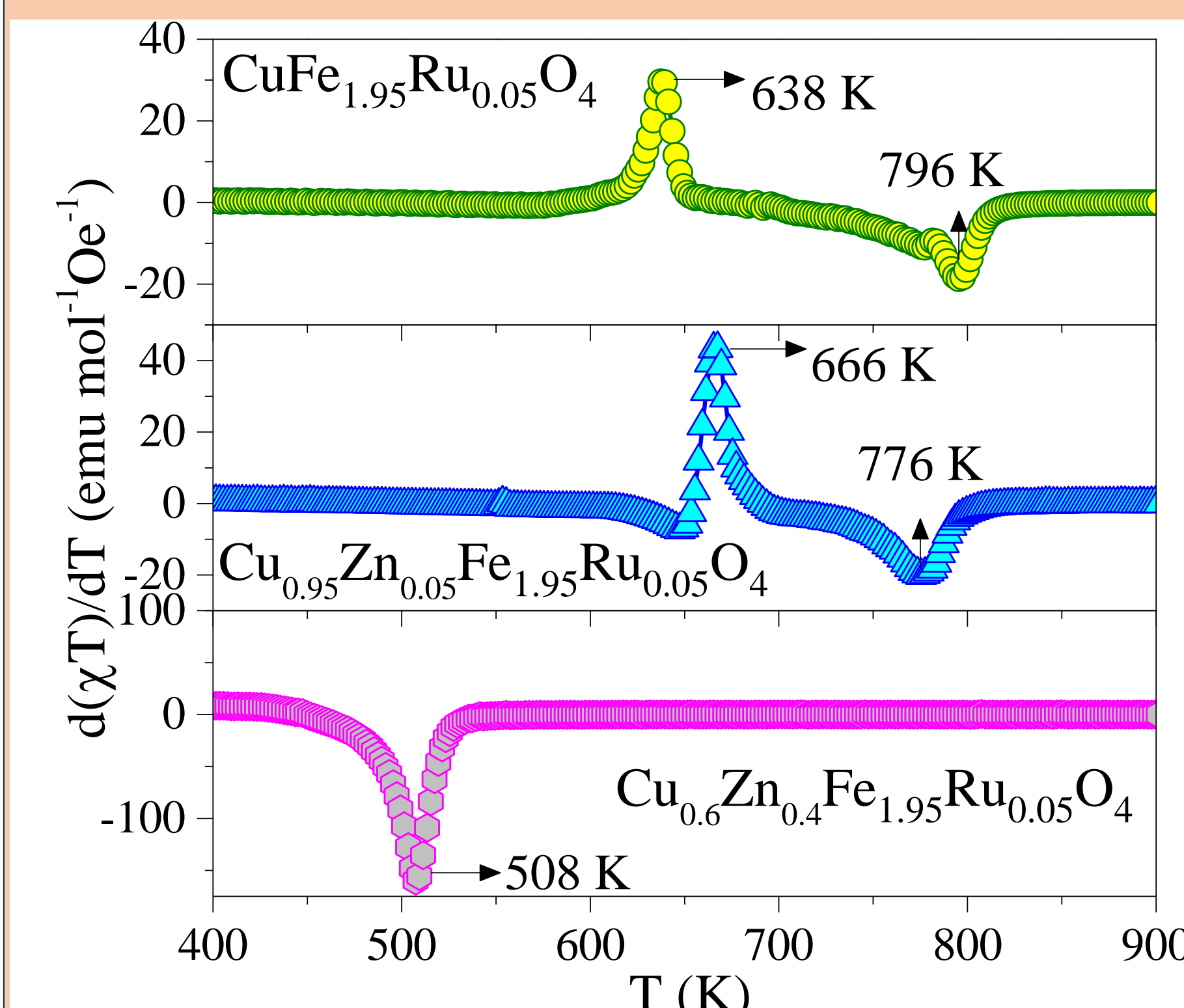
✓ $a = b = c = 8.416 \text{ \AA}$



- **compression Jahn-Teller distortion** experienced by the Cu-rich systems vanishes with Zn dilution at Cu^{2+} sites leading to a relaxed cubic structure

Results and Discussion

Ferrimagnetic Compounds



- With increase of Zn dilution, keeping the concentration of Ru constant, ferrimagnetic Néel temperature T_{FN} decreases significantly

Conclusions

- ✓ As the concentration of Zn increases, the system undergoes a structural transition from tetragonal to cubic at RT.
- ✓ With increase in Zn dilution, the second peak below T_{FN} vanishes. The lower temperature peak maybe due to spin reorientation and needs to be probed further
- ✓ As the concentration of Zn increases, the ferrimagnetic Néel temperature falls significantly as listed below:
 $\text{CuFe}_{1.95}\text{Ru}_{0.05}\text{O}_4$: **796 K**
 $\text{Cu}_{0.95}\text{Zn}_{0.05}\text{Fe}_{1.95}\text{Ru}_{0.05}\text{O}_4$: **776 K**
 $\text{Cu}_{0.6}\text{Zn}_{0.4}\text{Fe}_{1.95}\text{Ru}_{0.05}\text{O}_4$: **508 K**

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