

# SYNTHESIS AND CHARACTERIZATION OF HIGH TEMPERATURE SUPERCONDUCTOR Y123 USING GREEN CHEMISTRY METHOD

Mohammed Alawamleh<sup>1</sup>, Burhan Albiss<sup>2</sup>, Rula Albuqain<sup>3</sup>, Fayza Hannon<sup>4</sup>, Imad Hamadneh<sup>4</sup>



<sup>1</sup> Physics Department Faculty of Science, University of Jordan, Amman, Jordan

<sup>2</sup> Bio-Medical Physics Laboratory, Jordan University of Science and Technology, Irbid, Jordan

<sup>3</sup> Cell Therapy Centre (CTC), University of Jordan, Amman, Jordan

<sup>4</sup> Chemistry Department, Faculty of Science, University of Jordan, Amman, Jordan

## ABSTRACT

- Superconductivity is a macroscopic quantum phenomenon that happens when the material loses all its electrical resistivity, and the magnetic flux can be driven away from its structure.
- $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$  high-temperature superconducting ceramics were synthesized using neem fruit extraction as a green method.
- The TGA data indicate that a calcination and sintering temperature of 900–920 °C would be ideal
- The X-ray Diffraction (XRD) results showed the existence of an orthorhombic structure belonging to the RE123 superconducting phase.
- The zero-resistance temperature  $T_{C(R=0)}$  and onset temperature  $T_{C\text{-onset}}$  were in the range of 91.5K and 95K, respectively.

## METHOD AND MATERIALS

- Metal acetates were used in this work
- RE:Ba:Cu atomic ratio is 1:2:3, (we can calculate the masses stoichiometry by dividing each by the total molar mass in the whole reaction).

- Mixing the Raw Materials with Neem extract where its constituent materials act as an agents.



Figure 1: Neem.

- Heat treatment is required

- Neem contains more than 300 known compound, like Rutin epinin, nimbin, fraxinellone, azadiradione, vilasinin, azadirachtin, salannol, and others, as well as a high lipid content

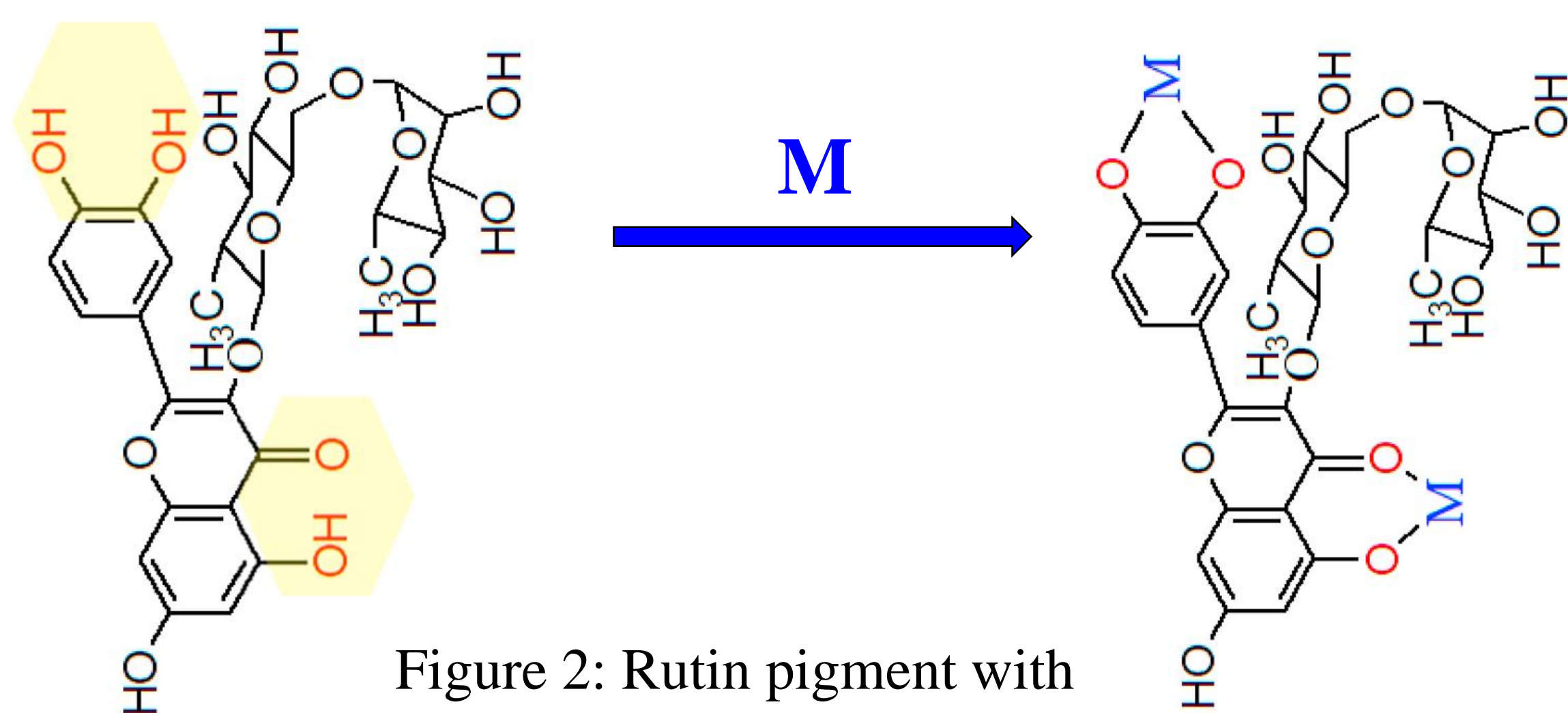


Figure 2: Rutin pigment with Divalent (M)

Calcination at 900 °C → Sintering at 920 °C

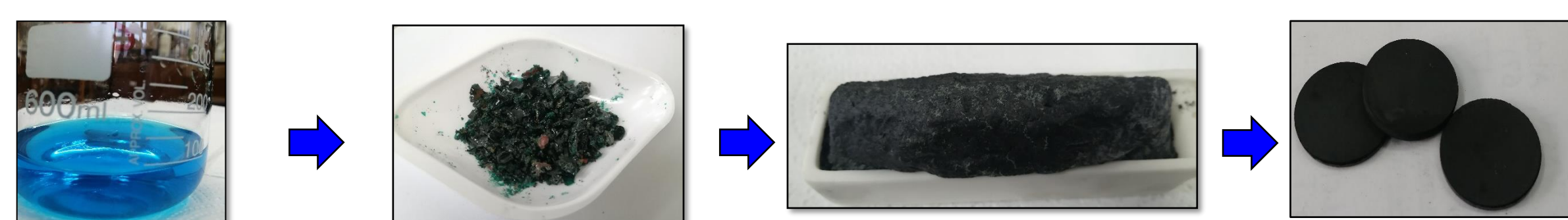


Figure 3: Synthesis procedure.

## 3. TGA

Four weight-loss phases (drops):

- 1<sup>st</sup> drop → 280°C (Humidity)
- 2<sup>nd</sup> drop → CuO, BaCO<sub>3</sub>, and RE<sub>2</sub>O<sub>3</sub>
- 3<sup>rd</sup> drop → BaCO<sub>3</sub> to BaO 900 °C
- 4<sup>th</sup> drop → REBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-δ</sub> 920 °C

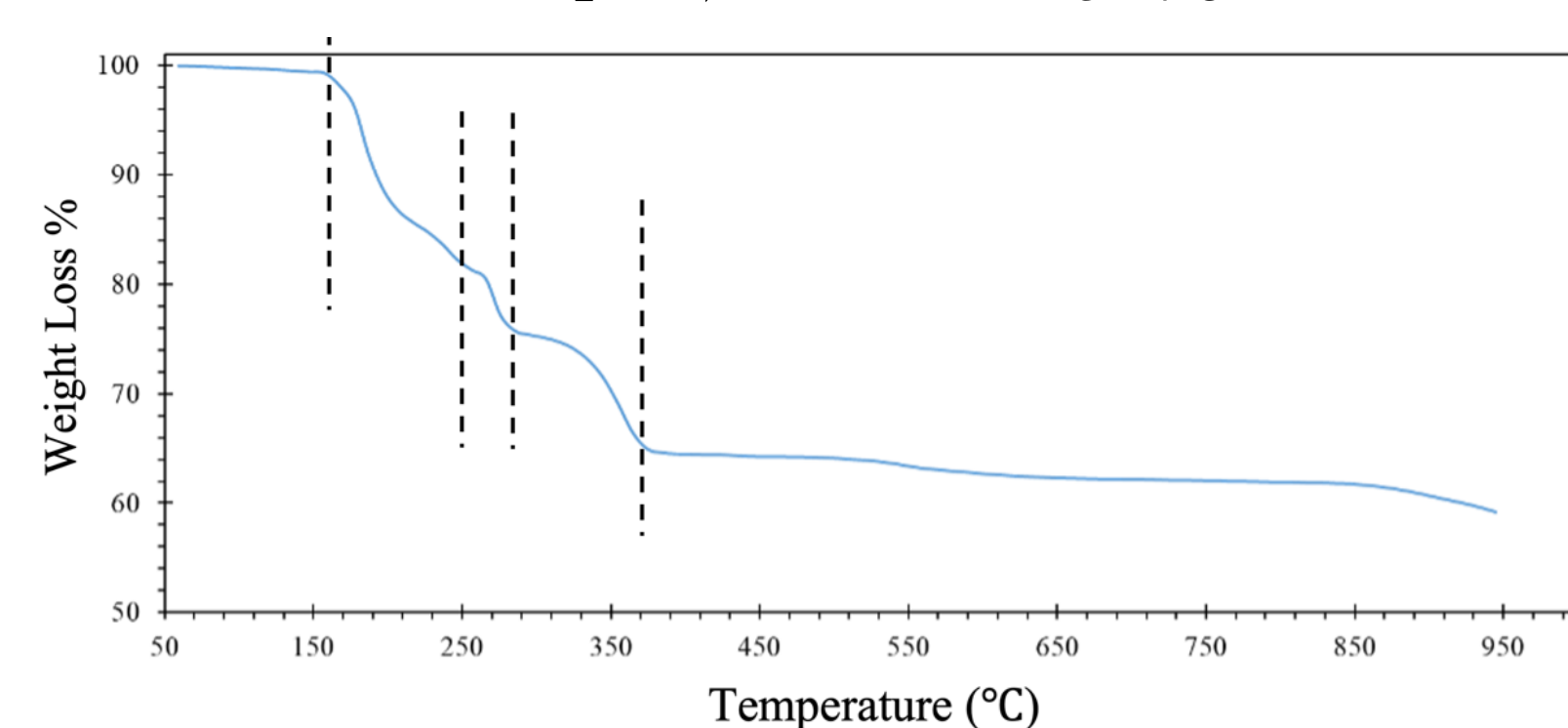


Figure 5: Thermogravimetric Analysis

## RESULTS: 1. XRD PROFILES

- XRD patterns for the sintered Y123 belong to the orthorhombic structure of the RE123 phase.
- Table 1: Lattice parameters

a(Å)	3.8240+0.0002
b(Å)	3.8860+0.0004
c(Å)	11.6744+0.0016
Volume(Å <sup>3</sup> )	173.477+0.032
123%	96.56(1.87)
Bragg R-factor	3.25
RF-factor	2.91

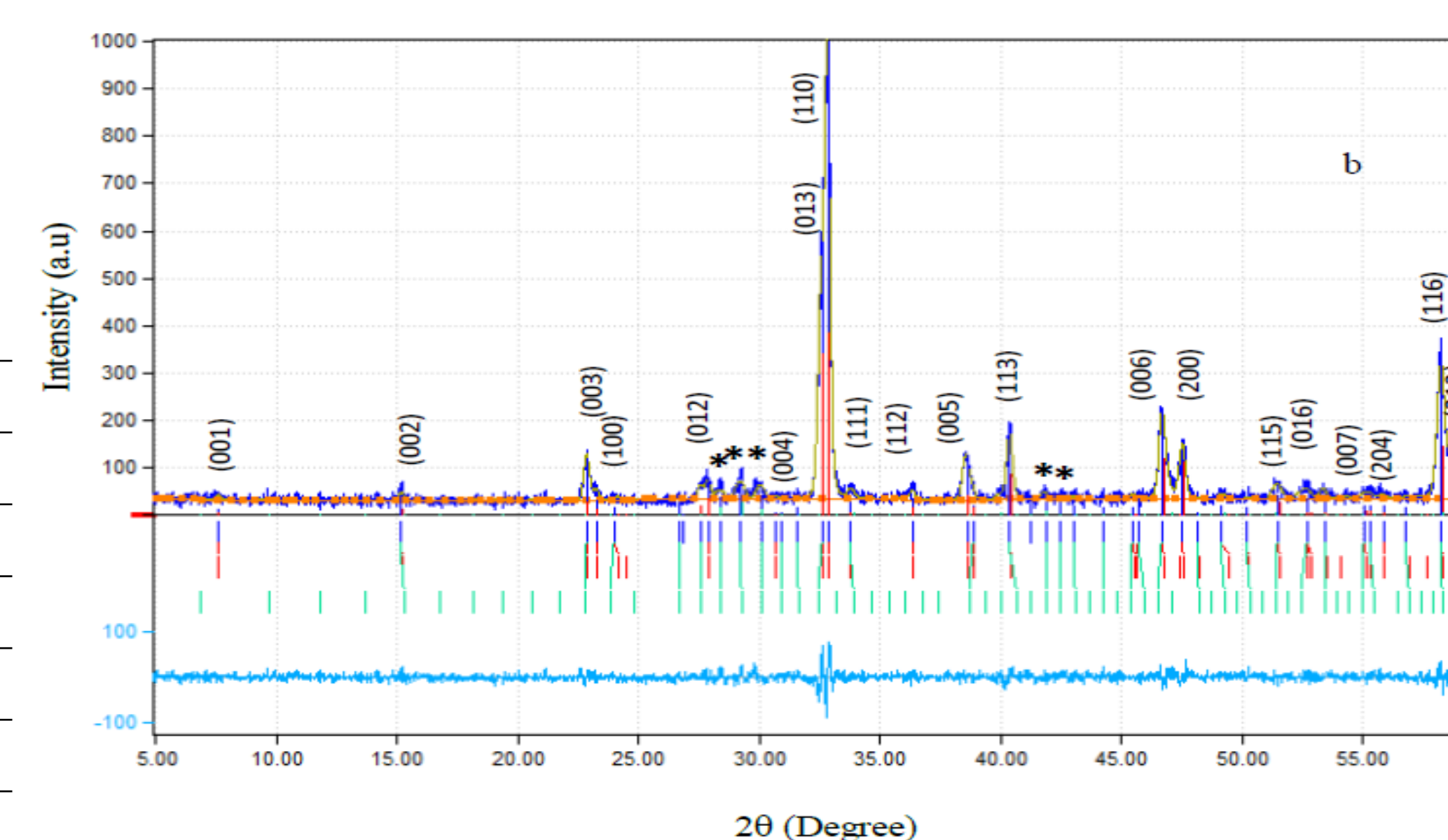


Figure 4: XRD Profiles.

## 2. SEM

- The fractured surface of sample Y123 exhibit a large, irregular shape grains that are arranged in compact shape is responsible to the grain connectivity
- Grain size ranged 7-15 μm and many pores and gaps are existed between the grains
- The average grain size for all the SEM samples gives a hint on the porosity of the samples

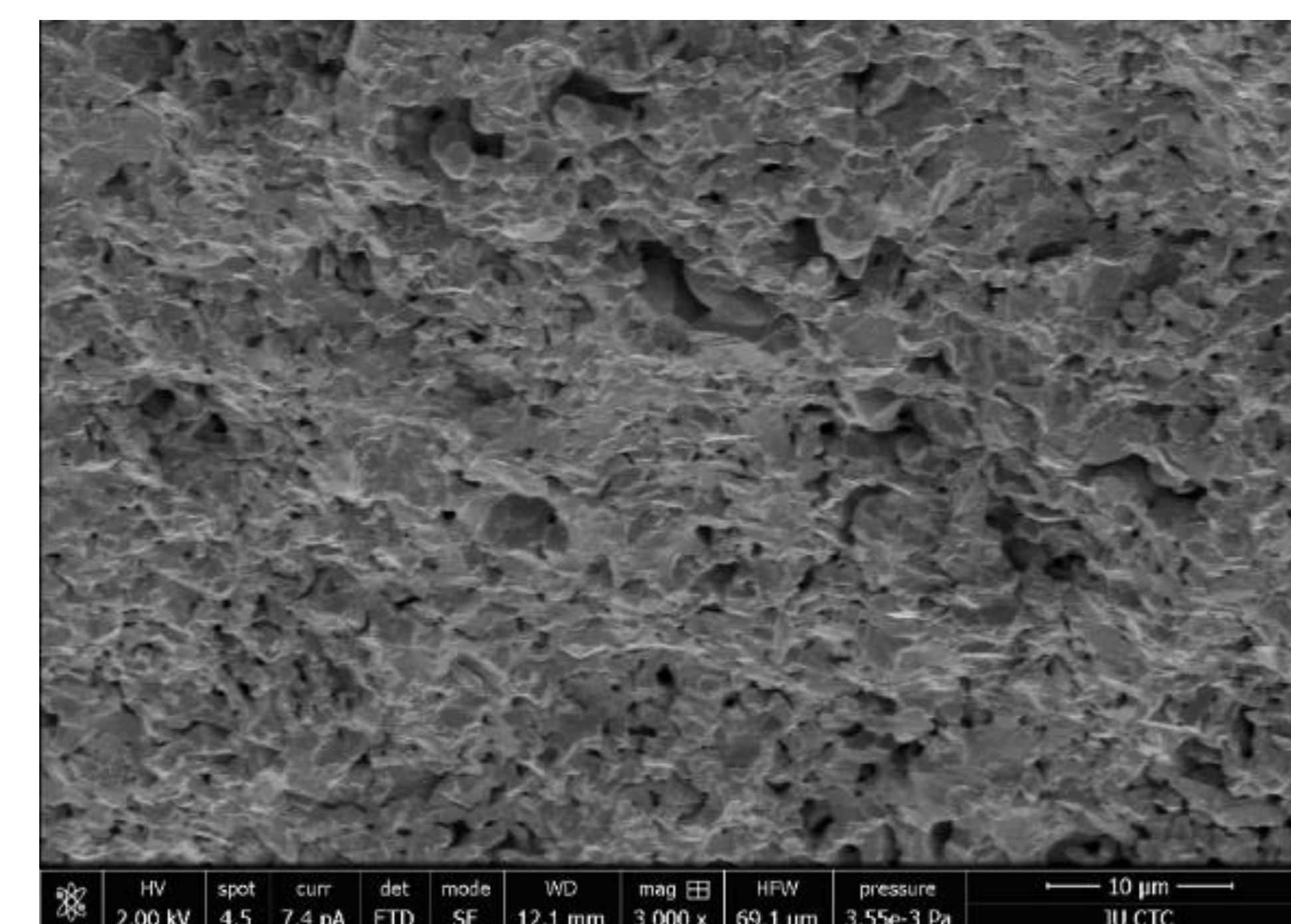
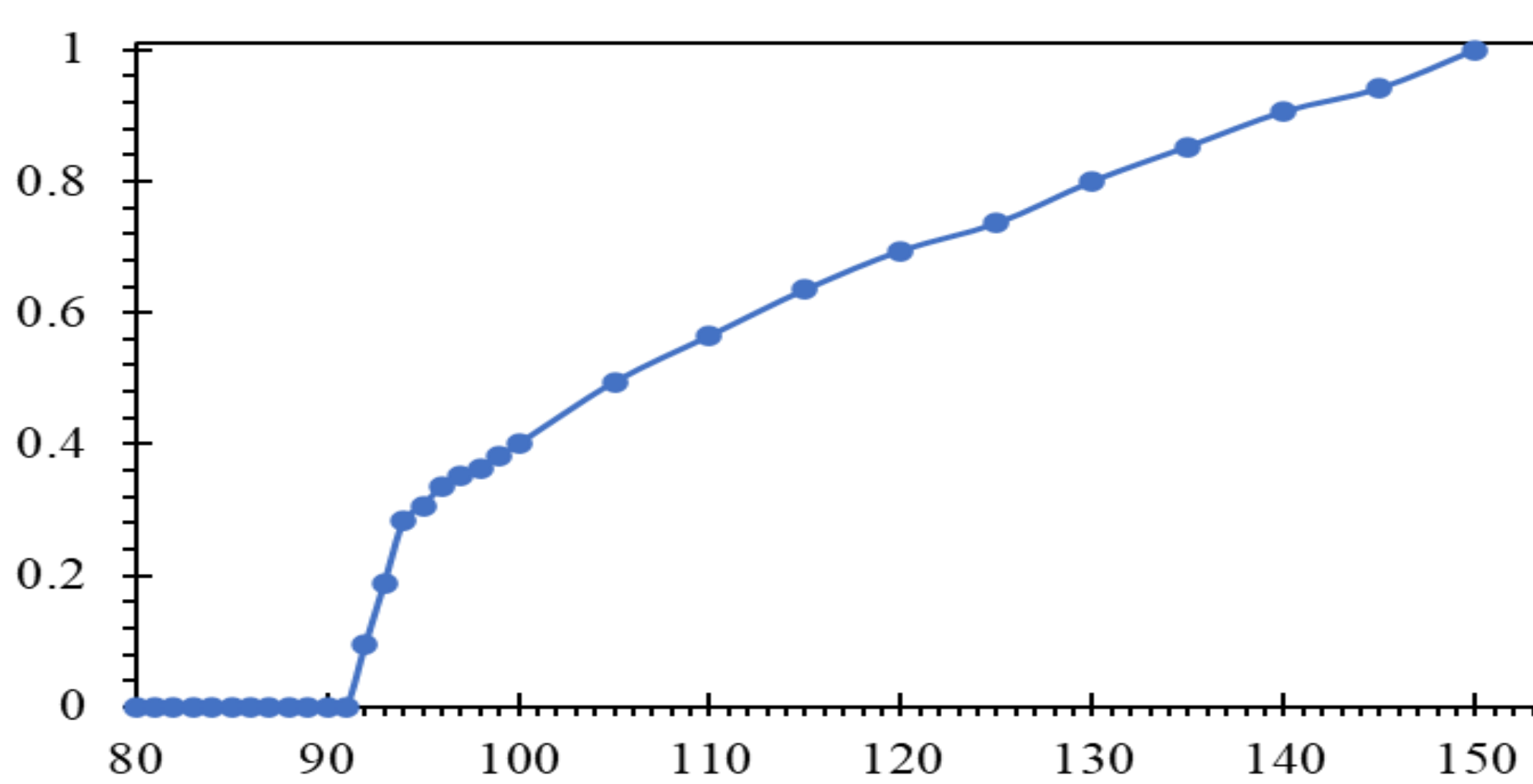


Figure 5: SEM Image.

## 4. LEVITATION



## 5. R-T CURVE OF Y123



## CONCLUSIONS

- The RE123 superconductor ceramics were successfully prepared using the green method.
- Based on the XRD results, all samples have orthorhombic structure.
- SEM results showed agglomerated grains with an average particle size of < 50 μm.
- $T_{C\text{-onset}}$  and  $T_{C(R=0)}$  are 95K and 91.5K, respectively.

## REFERENCES

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