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APPENDIX A

Calculation of Material Use

Y_2O_3 + $4BaCO_3$ + $6CuO$ ⟶ t

Molar Mass = (225.81) + 4(197.33) + 6(79.55)

= 1492.47 g/mol

To produce 50 g of $YBa_2Cu_3O_7$,

Y_2O_3	:	x g	:	1 mol	:	225.81 g/mol
t	:	50 g	:	1 mol	:	1492.47 g/mol

$$\frac{x}{50} = \frac{1(225.81)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$x = (50) \times \frac{1(225.81)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$x = 7.55\text{g}$$

$BaCO_3$	:	y g	:	4 mol	:	197.34 g/mol
t	:	50 g	:	1 mol	:	1492.47 g/mol

$$\frac{\text{y}}{50} = \frac{4(197.34)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$y = (50) \times \frac{1(197.34)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$y = 26.45 \text{ g}$$

CuO	:	z g	:	2 mol	:	79.55 g/mol
t	:	50 g	:	1 mol	:	1492.47 g/mol

$$\frac{z}{50} = \frac{2(79.55)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$z = (50) \times \frac{2(79.55)}{1(1.492.47)} \frac{\text{g}}{\text{mol}}$$

$$z = 16.0 \text{ g}$$

Therefore, the amount of Y_2O_3, $BaCO_3$ and CuO required to produce 50 g of $YBa_2Cu_3O_7$, are 7.55 g, 26.45 g and 16.0 g respectively.

APPENDIX B

Lattice Parameter Calculation

$$\frac{1}{d^2} = \frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}$$

For YBCO + 0.00 wt% PbO

At (0 1 0) plane

$$\frac{1}{3.889^2} = \frac{1^2}{b^2}$$

$$b = 3.889 \text{ Å}$$

At (2 2 0) plane

$$\frac{1}{1.366^2} = \frac{2^2}{a^2} + \frac{2^2}{3.889^2}$$

$$\frac{4}{a^2} = 0.5359 - 0.2645$$

$$\frac{a^2}{4} = 3.6840$$

$$a = 3.8387 \text{ Å}$$

At (0 1 4) plane

$$\frac{1}{2.3305^2} = \frac{1^2}{3.889^2} + \frac{4^2}{c^2}$$

$$\frac{16}{c^2} = 0.1841 - 0.0661$$

$$\frac{c^2}{16} = 8.4746$$

$$c = 11.644 \text{ Å}$$

Therefore, the lattice parameter for non-added YBCO sample is

$a = 3.8387$ Å, $b = 3.889$ Å and $c = 11.644$ Å.

For YBCO + 0.01 wt% PbO

At (0 0 2) plane

$$\frac{1}{5.809^2} = \frac{2^2}{c^2}$$

$$c = 11.618 \text{ Å}$$

At (0 1 2) plane

$$\frac{1}{3.197^2} = \frac{1^2}{b^2} + \frac{2^2}{11.618^2}$$

$$\frac{1}{b^2} = 0.0978 - 0.0296$$

$$\frac{b^2}{1} = 14.6702$$

$$b = 3.8291 \text{ Å}$$

At (1 1 2) plane

$$\frac{1}{2.4656^2} = \frac{1^2}{a^2} + \frac{1^2}{3.8291^2} + \frac{2^2}{11.618^2}$$

$$\frac{1}{a^2} = 0.1645 - 0.0682 - 0.0296$$

$$a^2 = 14.9925$$

$$a = 3.8721 \text{ Å}$$

Therefore, the lattice parameter for non-added YBCO sample is

$a = 3.8721$ Å, $b = 3.8291$ Å and $c = 11.618$ Å.

For YBCO + 0.02 wt% PbO

At (0 2 0) plane

$$\frac{1}{1.9079^2} = \frac{2^2}{b^2}$$

$$b = 3.8158 \text{ Å}$$

At (0 0 3) plane

$$\frac{1}{3.873^2} = \frac{3^2}{c^2}$$

$$b = 11.619 \text{ Å}$$

At (1 0 3) plane

$$\frac{1}{2.7390^2} = \frac{1^2}{a^2} + \frac{3^2}{11.619^2}$$

$$\frac{1}{a^2} = 0.1333 - 0.0667$$

$$a^2 = 15.015$$

$$a = 3.8750$$

Therefore, the lattice parameter for non-added YBCO sample is

$a = 3.8750$ Å, $b = 3.8158$ Å and $c = 11.619$ Å

For YBCO + 0.03 wt% PbO

At (2 0 0) plane

$$\frac{1}{1.9114^2} = \frac{2^2}{a^2}$$

$a = 3.8228$ Å

At (0 2 0) plane

$$\frac{1}{1.9465^2} = \frac{2^2}{b^2}$$

$b = 3.8930$ Å

At (0 0 3) plane

$$\frac{1}{3.893^2} = \frac{3^2}{c^2}$$

$c = 11.679$ Å

Therefore, the lattice parameter for non-added YBCO sample is

$a = 3.8228$ Å, $b = 3.8930$ Å and $c = 11.679$ Å.

For YBCO + 0.04 wt% PbO

At (2 0 0) plane

$$\frac{1}{1.9082^2} = \frac{2^2}{a^2}$$

$a = 3.8164$ Å

At (0 1 0) plane

$$\frac{1}{3.877^2} = \frac{1^2}{b^2}$$

$b = 3.877$ Å

At (0 0 7) plane

$$\frac{1}{1.6654^2} = \frac{7}{c^2}$$

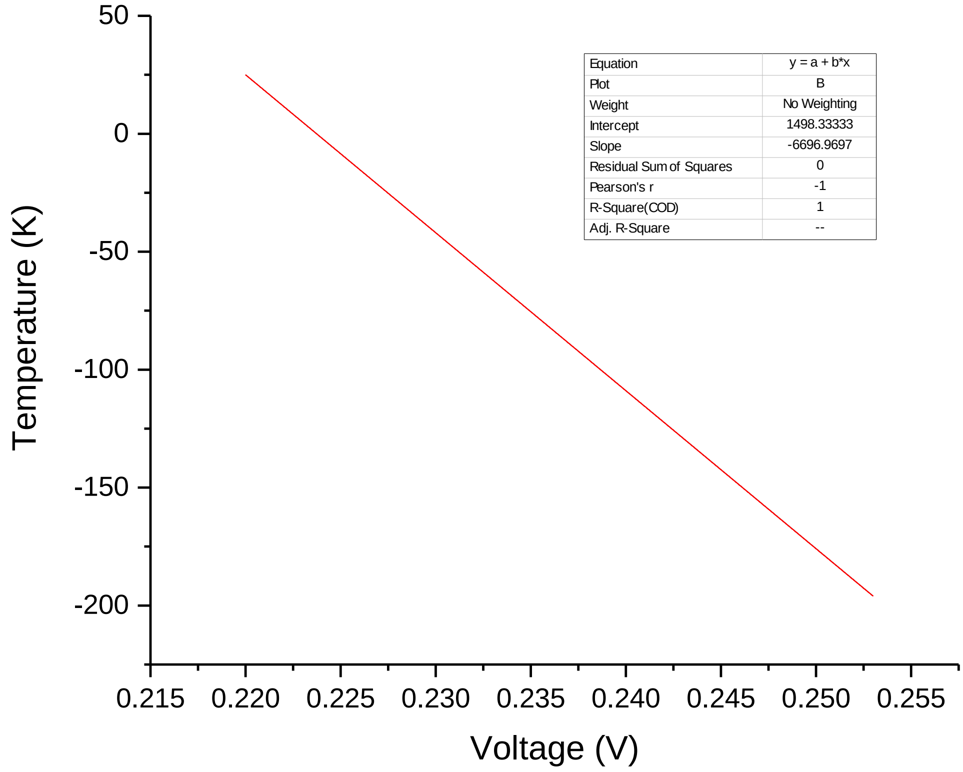
$c = 11.658$ Å

Therefore, the lattice parameter for non-added YBCO sample is

$a = 3.8164$ Å, $b = 3.877$ Å and $c = 11.658$ Å.

APPENDIX C

Calculation of critical temperature, T_c



Using the function of the line $y = -6696.97x + 1498.33$, the corresponding recorded temperature of the thermocouple was calculated.

The resistance was calculated using the formula;

$$V = IR$$

$$R = \frac{I}{V}$$

The graph of resistance against temperature was then plotted as shown in Figure 4.11 to Figure 4.14