The Effect of TiO_2 Addition on the Characteristics of $CuFe_2O_4$ Ceramics for NTC Thermistors

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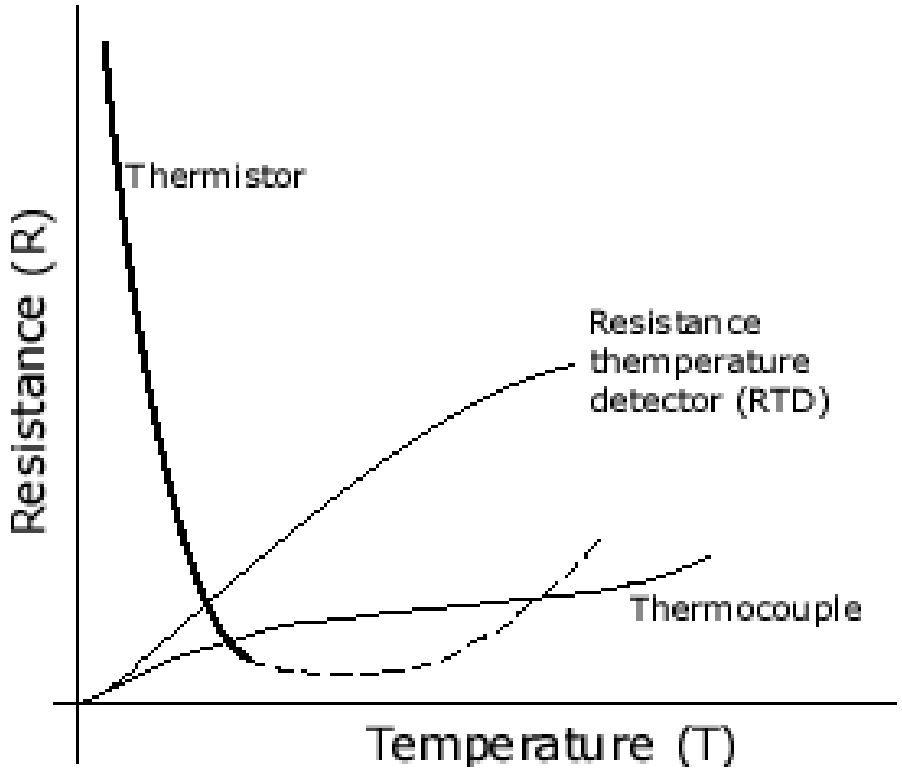
INTRODUCTION

- THERMISTOR→ Thermally Sensitive Resistor.
- NTC CHARACTERISTIC : PRODUCT EXAMPLES:



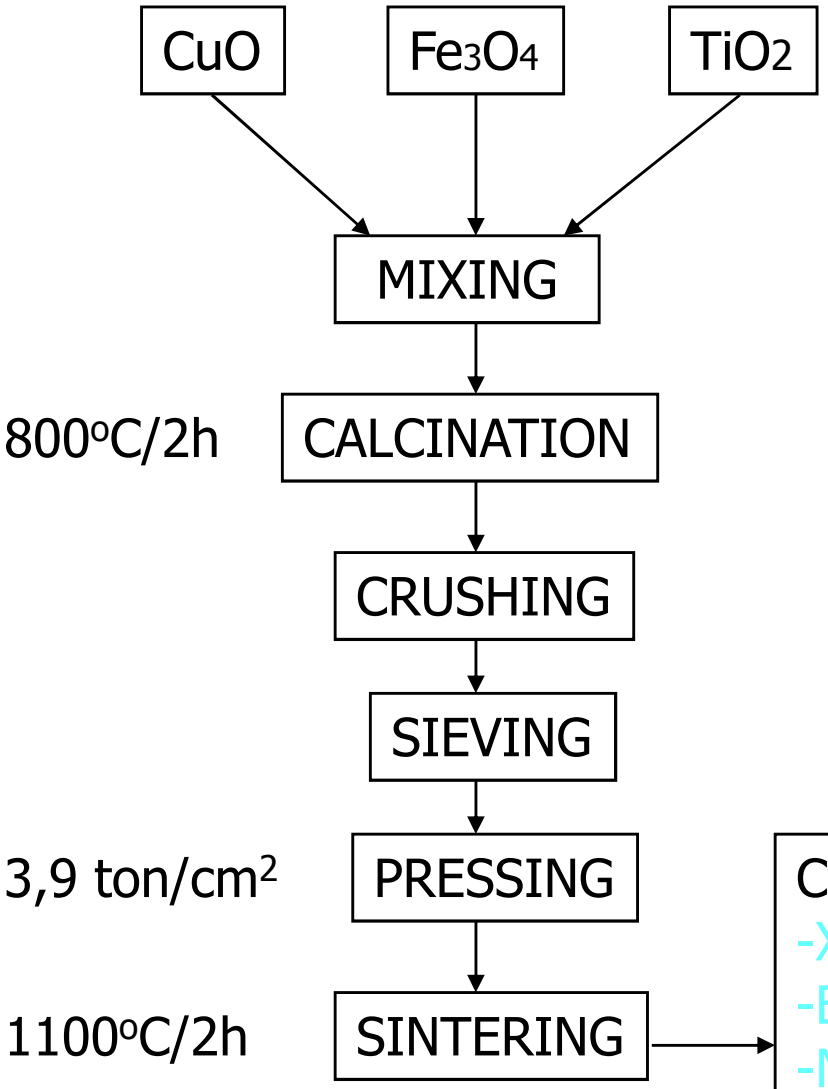
INTRODUCTION (Continuation)

- Important electronic component.

  - Sectors: Biomedical, aerospace, instrumentation, communications, automotive and HVACR (Heating, Ventilation, Air conditioning and Refrigeration).

  -Application : Temperature measurement, circuit compensation, suppression of in rush-current, flow rate sensor and pressure sensor.
- Most, thermistors are produced from spinel ceramics based on transition metal oxides forming general formula AB_2O_4.
- Need alternative (Expecially based on abundant material (mineral) in Indonesia) → $CuFe_2O_4$ is proposed, including that added with TiO_2.
- Predicted that the TiO_2 addition can improve the characteristics of the $CuFe_2O_4$ ceramic for NTC thermistors.

EXPERIMENT

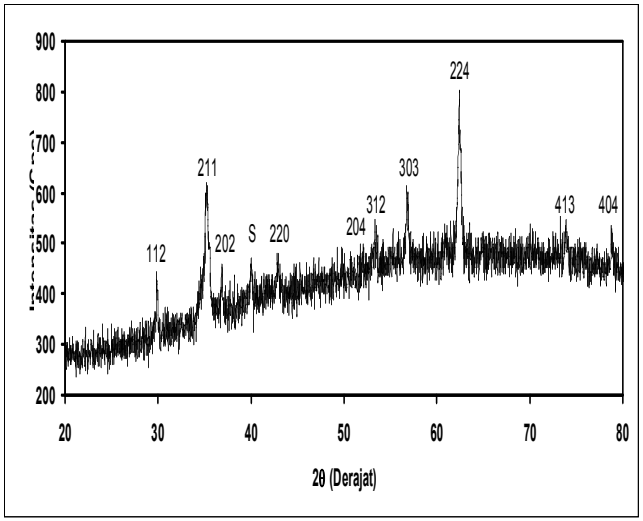


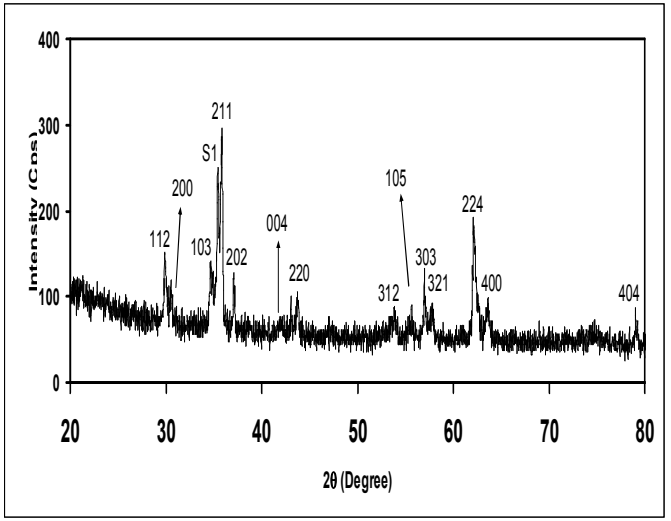
Sintering Furnace

Optical Microscope

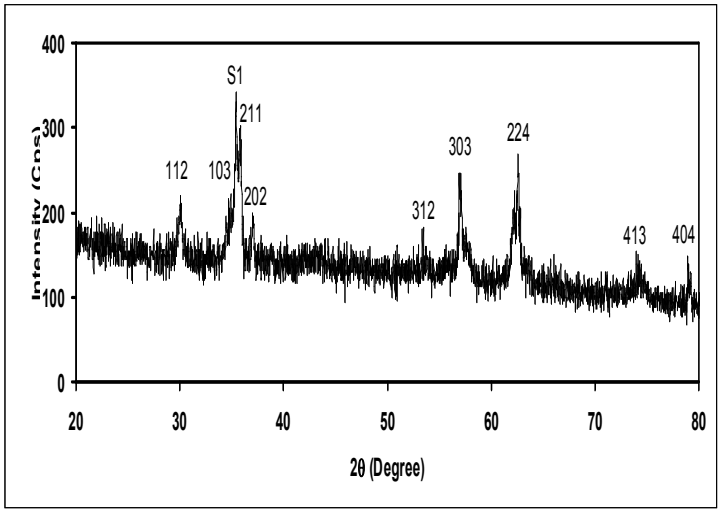
RESULTS (XRD)

0 w/o TiO_2





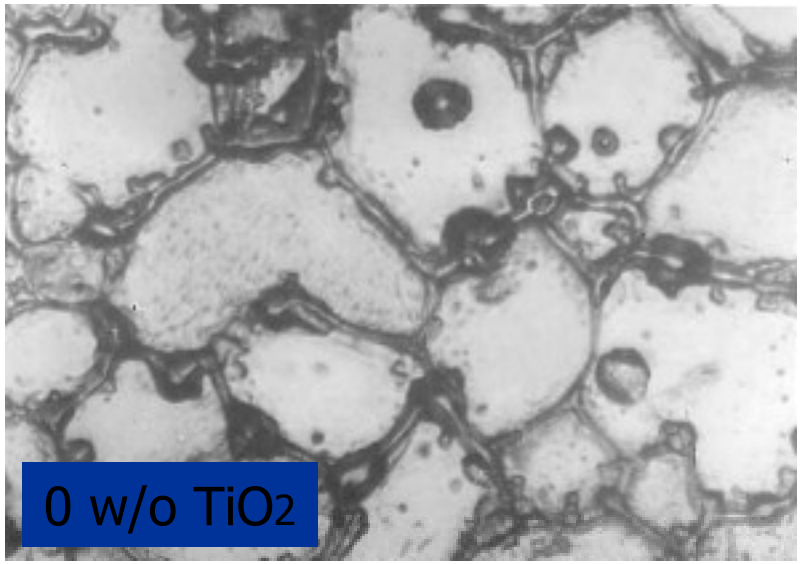
0.25 w/o TO_2

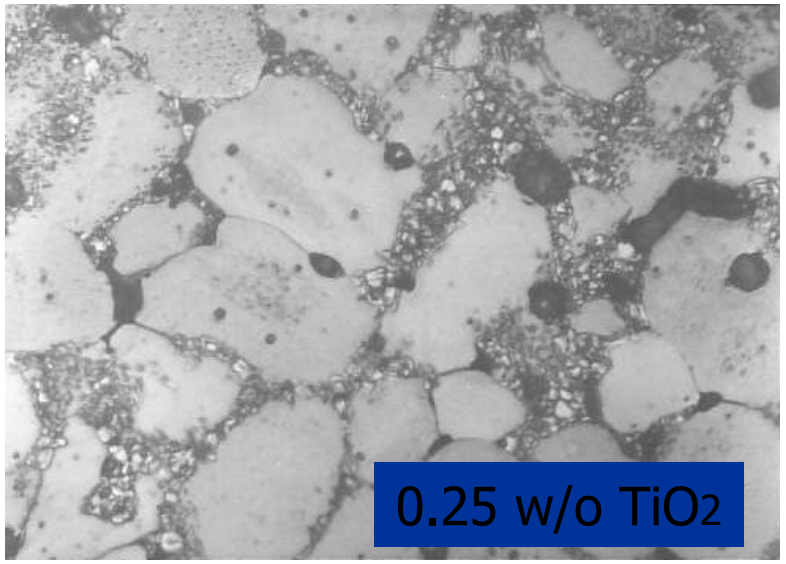


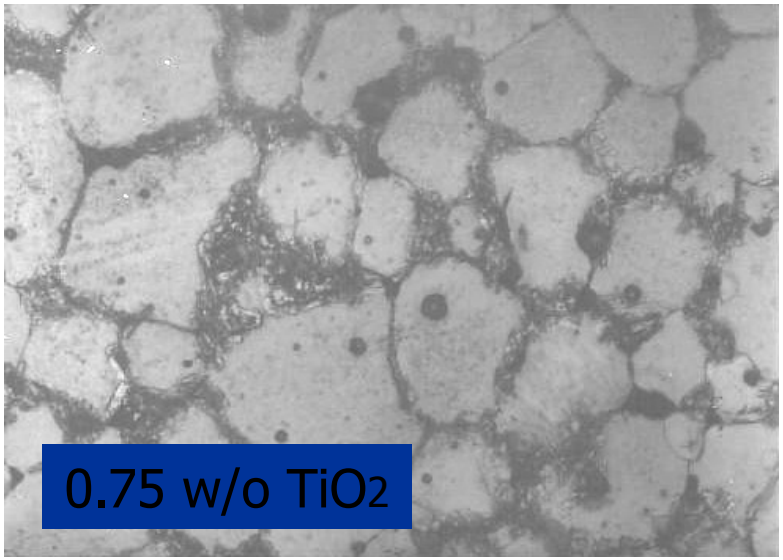
0.75 % TiO_2

XRD profiles of $CuFe_2O_4$ based-ceramics.

RESULTS (Microstructure)

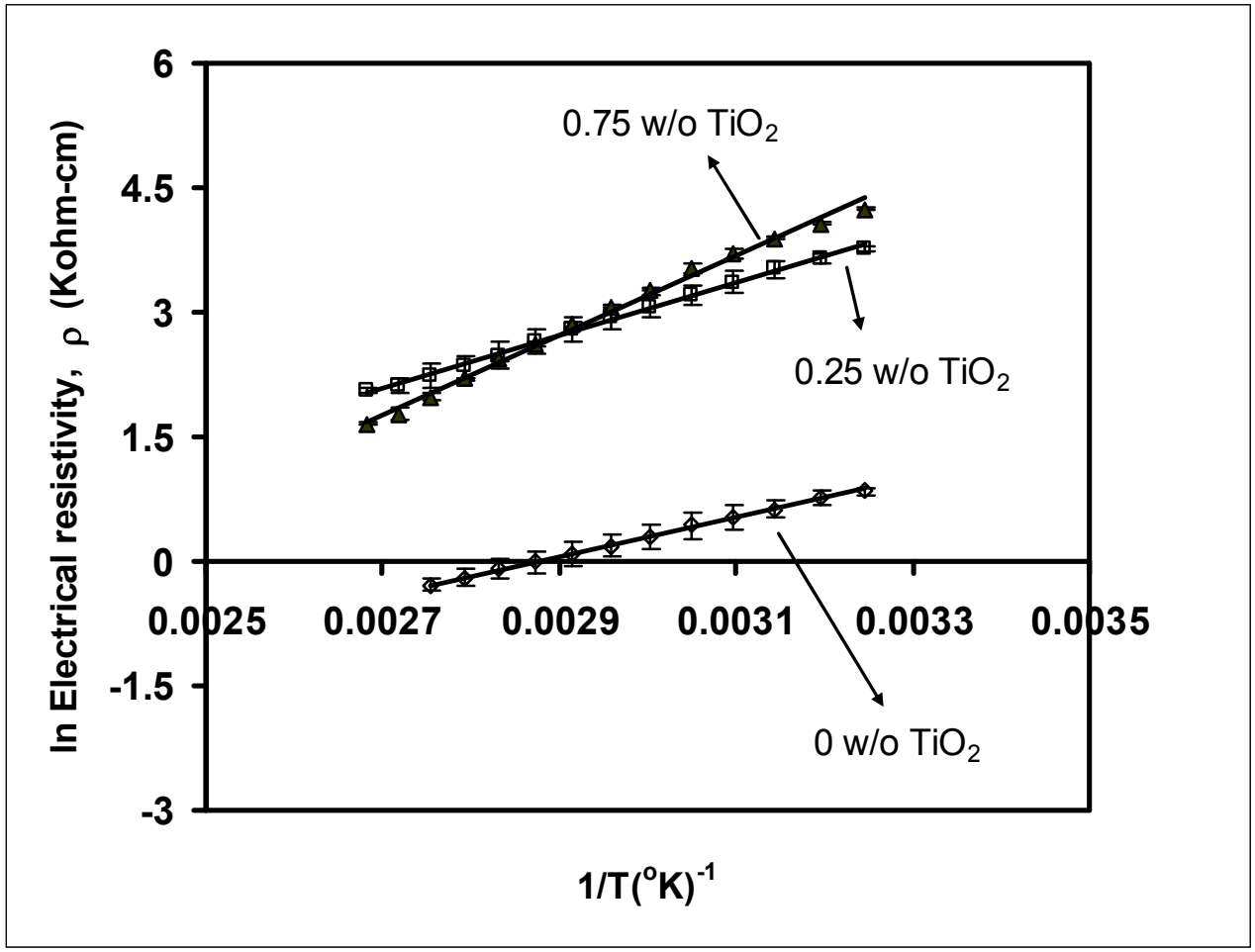






Microstructure of the $CuFe_2O_4$ based-ceramics.

RESULTS (Electrical Characteristics)



Ln resistivity (ρ) vs $1/T$ of TiO_2 added- $CuFe_2O_4$ ceramics.

RESULTS (Electrical Characteristics)

No.	Additive of TiO_2 (w/o)	B (^oK)	α (%/^oK)	ρ_{RT} (Kohm-cm)
1.	0	2350	2.61	2.9
2.	0.25	3187	3.54	60.5
3.	0.75	4759	5.29	119.9

Market requirement for B is ≥ 2000 ^oK and α is ≥ 2.2 %/^oK[7], market requirement for ρ_{RT} = 10 ohm.cm -1 Mohm.cm [4].

CONCLUSIONS

- The $CuFe_2O_4$ ceramics can be applied as NTC Thermistor.
- The grain size of the $CuFe_2O_4$ ceramics tends to decrease by addition of TiO_2.
- The addition of TiO_2 increased the room temperature resistivity (ρRT) and the thermistor constant (B) of the $CuFe_2O_4$ ceramics due to the segregated TiO_2.
- The value of (ρ_{RT}) and (B) of the $CuFe_2O_4$ ceramics made in this work fits the market requirement.

THANK YOU