



# The Effect Of $\text{SiO}_2$ Addition On The Characteristics Of $\text{CuFe}_2\text{O}_4$ Ceramics For NTC Thermistor



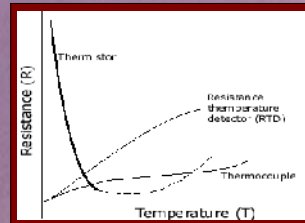
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## INTRODUCTION

- THERMISTOR → Thermally Sensitive Resistor.
- NTC CHARACTERISTIC :

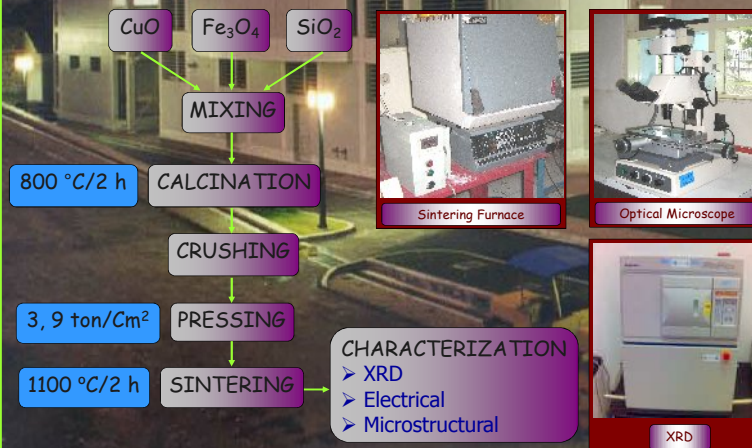


## PRODUCT EXAMPLES:

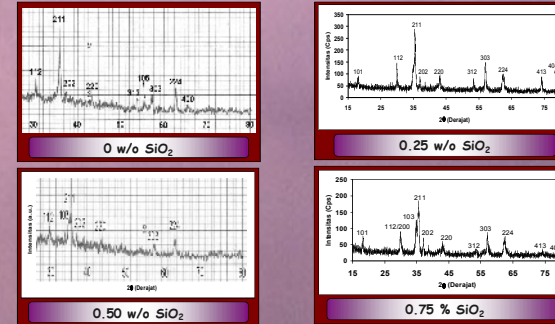


- Important electronic component.
  - **Sectors:** Biomedical, aerospace, instrumentation, communications, automotive and HVAC (Heating, Ventilation, Air conditioning and Refrigeration).
  - **Application :** Temperature measurement, circuit compensation, suppression of in rush-current, flow rate sensor and pressure sensor.
- Most, thermistors are produced from spinel ceramics based on transition metal oxides forming general formula  $\text{AB}_2\text{O}_4$ .
- Need alternative (Especially based on abundant material (mineral) in Indonesia) →  $\text{CuFe}_2\text{O}_4$  is proposed, including that added with  $\text{SiO}_2$ .
- Predicted that the  $\text{SiO}_2$  addition can improve the characteristics of the  $\text{CuFe}_2\text{O}_4$  ceramic for NTC thermistors

## EXPERIMENT

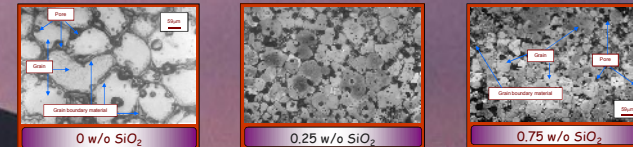


## RESULT (XRD)



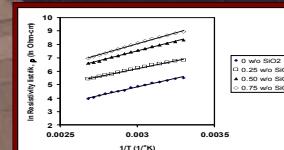
XRD profiles of  $\text{CuFe}_2\text{O}_4$  based-ceramics

## RESULTS (Microstructure)



Microstructure of the  $\text{CuFe}_2\text{O}_4$  based-ceramics

## RESULTS (Electrical Characteristics)



Ln resistivity ( $\rho$ ) vs  $1/T$  of  $\text{SiO}_2$  added-  $\text{CuFe}_2\text{O}_4$  ceramics

No.	Additive of $\text{TiO}_2$ (w/o)	B (K)	$\alpha$ (%/K)	$\rho_{RT}$ (Ohm-Cm)
1.	0.00	2548	2.83	291
2.	0.25	2358	2.62	1079
3.	0.50	2884	3.20	4788
4.	0.75	3308	3.68	9400

Market requirement for  $B \geq 2000$  aK and  $\alpha \geq 2.2$  %/aK  
Market requirement for  $\rho_{RT} = 10$  ohm.cm - 1 Mohm.cm

## CONCLUSIONS

- The  $\text{CuFe}_2\text{O}_4$  ceramics can be applied as NTC Thermistor.
- The grain size of the  $\text{CuFe}_2\text{O}_4$  ceramics tends to decrease by addition of  $\text{SiO}_2$ .
- The addition of  $\text{SiO}_2$  increases the room temperature resistivity ( $\rho_{RT}$ ) and the thermistor constant (B) of the  $\text{CuFe}_2\text{O}_4$  ceramics due to the segregated  $\text{SiO}_2$ .
- The value of ( $\rho_{RT}$ ) and (B) of the  $\text{CuFe}_2\text{O}_4$  ceramics made in this work fits the market requirement.

## REFERENSI

- BetaTHERM Sensors [on line]. Available: <http://www.betatherm.com>.
- Eun Sang Na, Un Gyu paik, Sung Churl Choi, "The effect of a sintered microstructure on the electrical properties of a Mn-Co-Ni-O thermistor", Journal of Ceramic Processing Research, Vol.2, No. 1, pp 31-34, 2001.
- Wiendartun, Dani Gustaman Syarif. The Effect of  $\text{TiO}_2$  Addition on the Characteristics of Sciences (ICMNS) 2006, ITB, Bandung, October 2006.

## ACKNOWLEDGMENT

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