The Effect of SiO2 Addition on the Characteristics of CuFe2O4 Ceramics for NTC Thermistors

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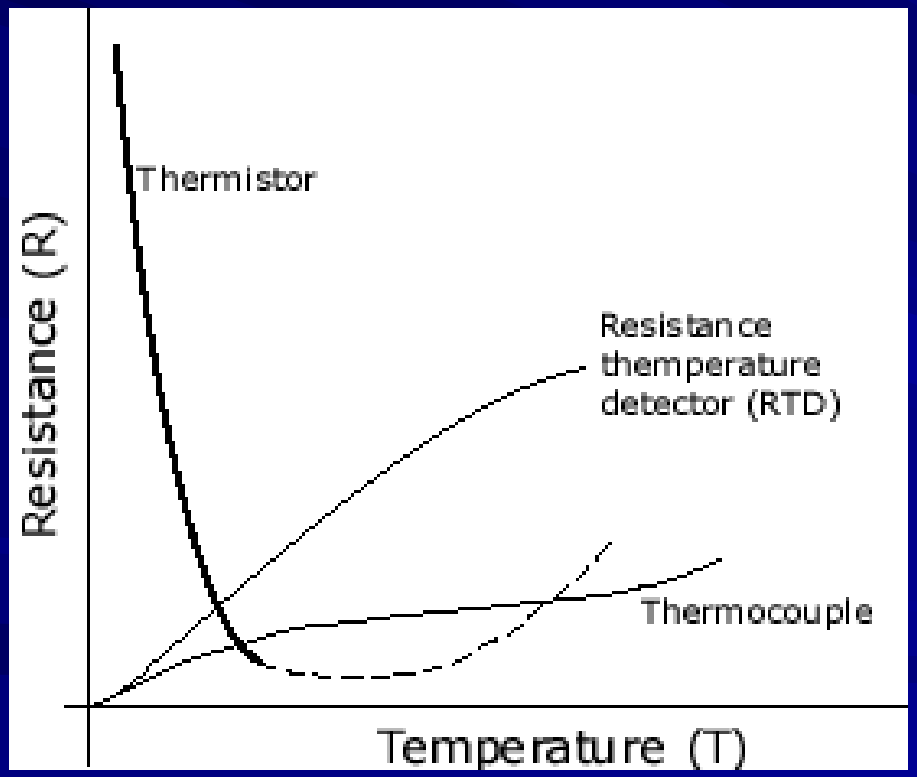
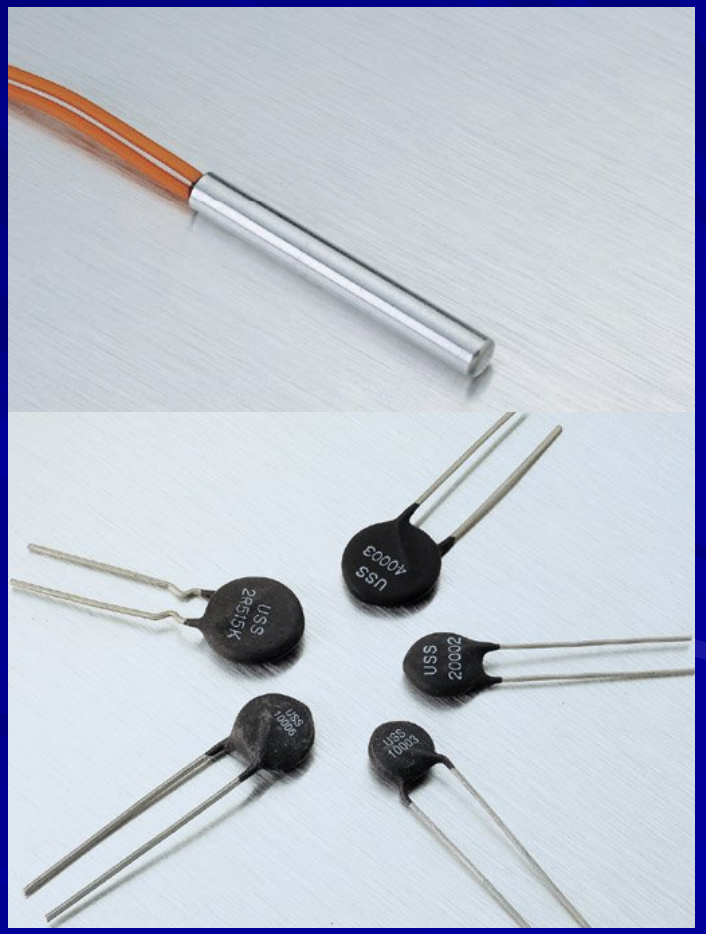
INTRODUCTION

- 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 SiO_2.
- Predicted that the SiO_2 addition can improve the characteristics of the $CuFe_2O_4$ ceramic for NTC thermistors.

EXPERIMENT

CuO + Fe_3O_4 + SiO_2

MIXING

800°C/2h — CALCINATION

CRUSHING

SIEVING

3,9 ton/cm^2 — PRESSING

1100°C/2h — SINTERING

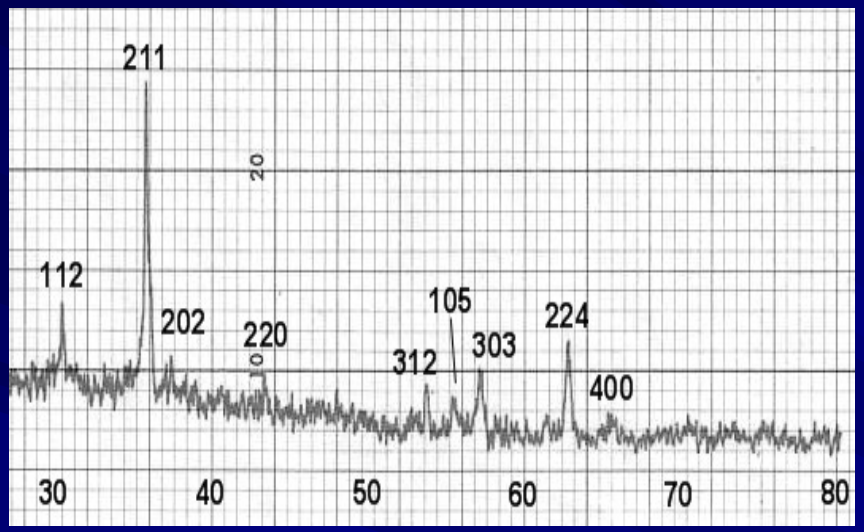
CHARACTERIZATION
-XRD
-Electrical
-Microstructural

Sintering Furnace

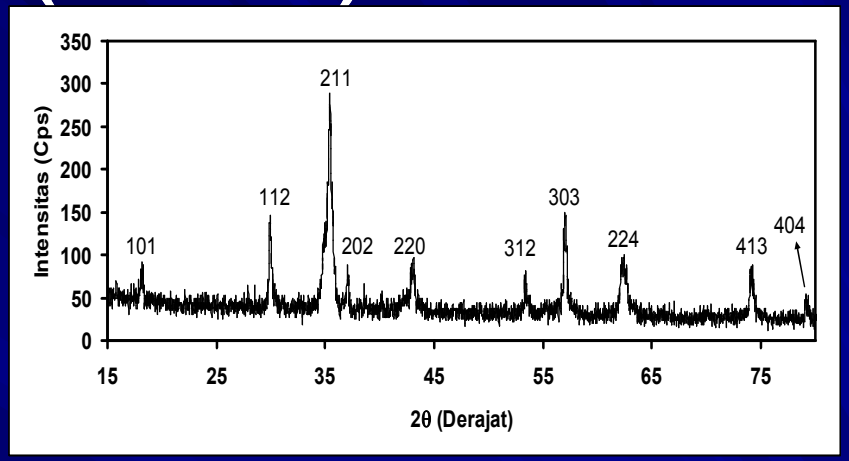
XRD

Optical Microscope

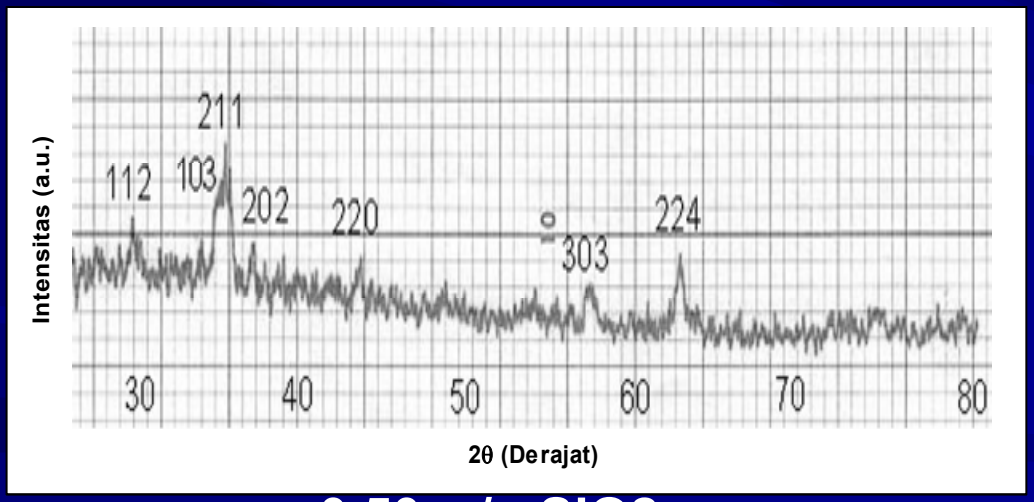
RESULTS (XRD)



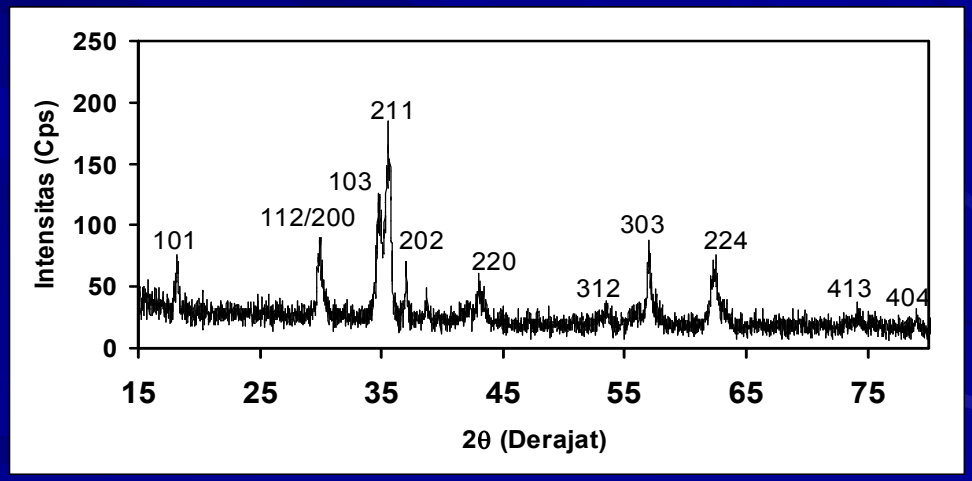
0 w/o SiO_2



0.25 w/o SiO_2



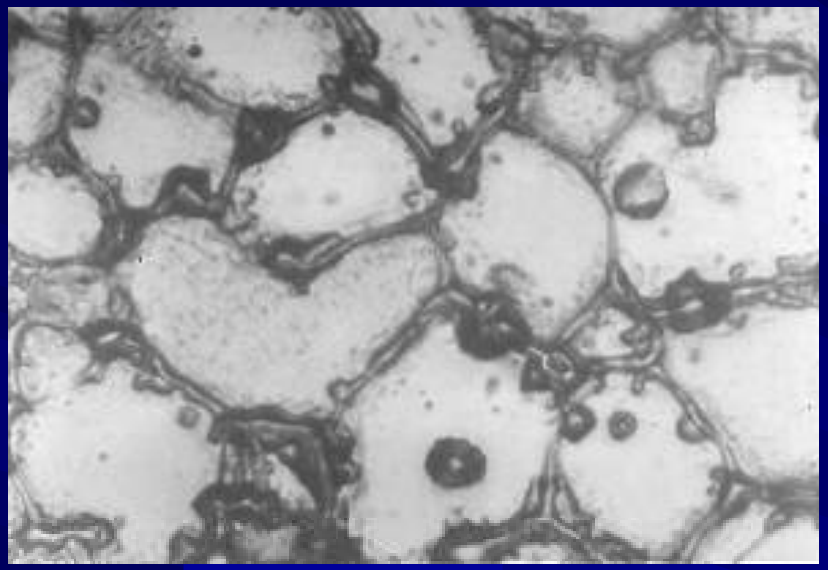
0.50 w/o SiO_2



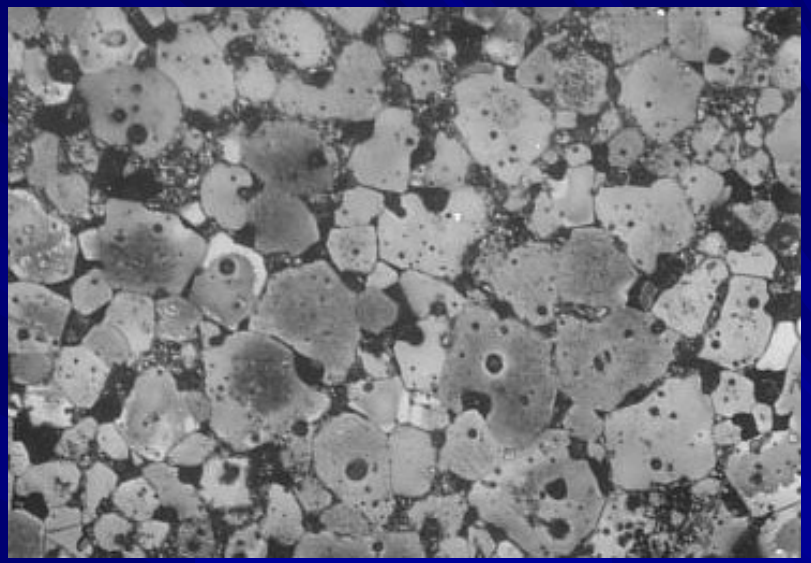
0.75 % SiO_2

XRD profiles of $CuFe_2O_4$ based-ceramics.

RESULTS (Microstructure)

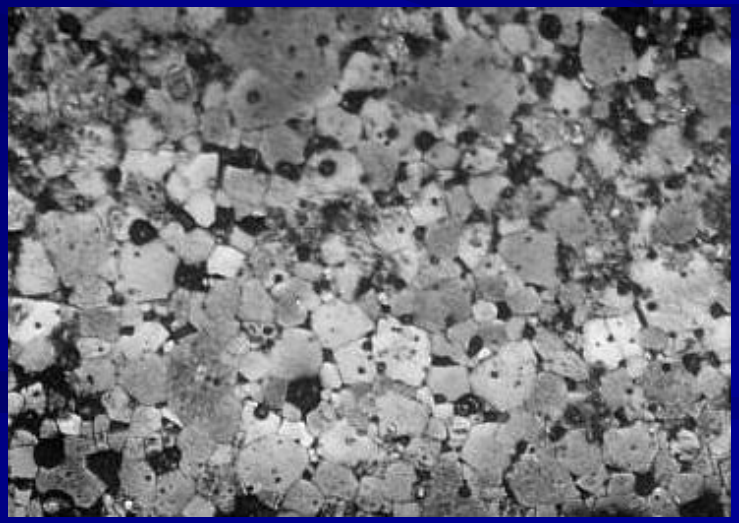


0 w/o SiO_2



0.25 w/o SiO_2

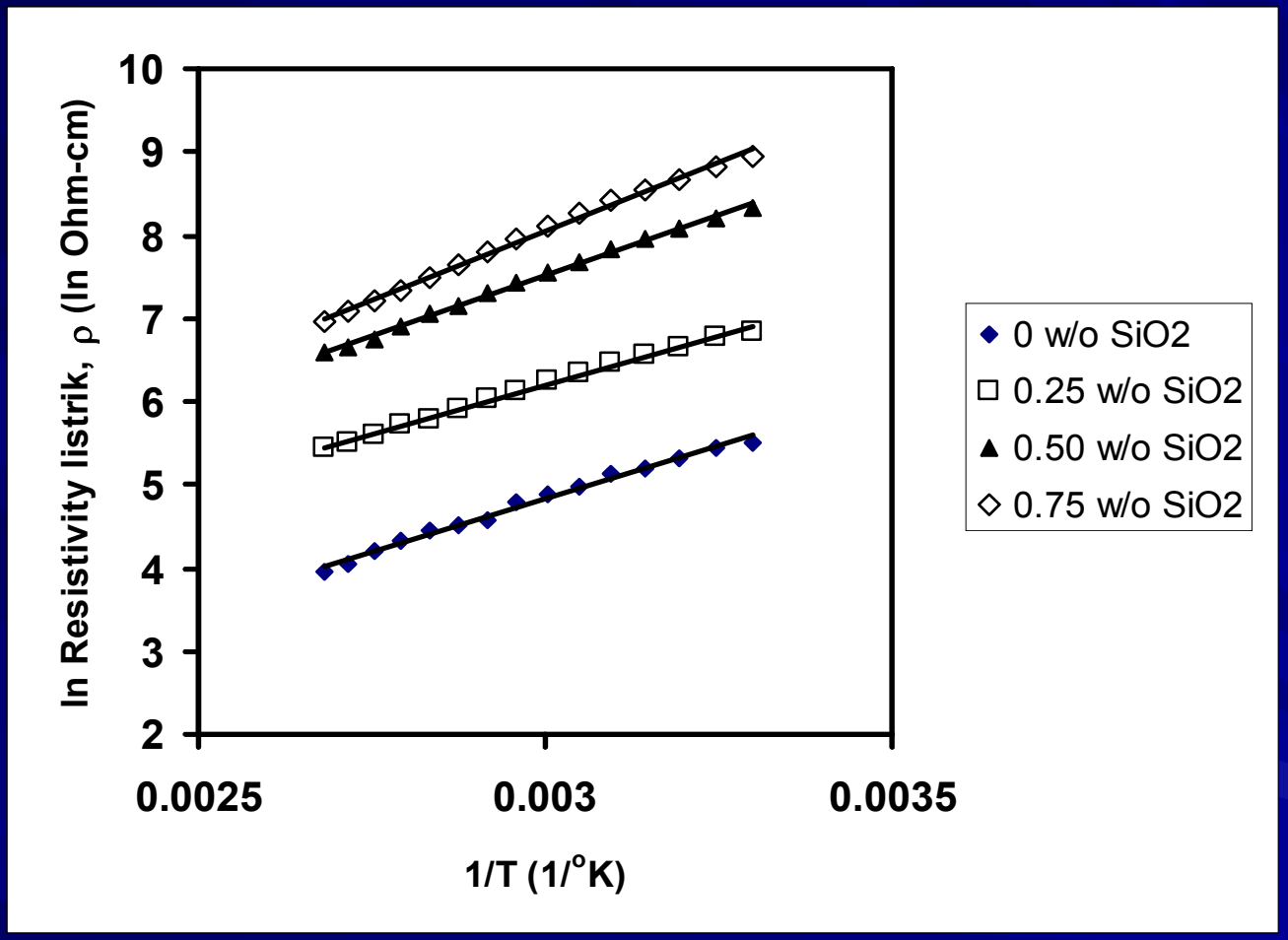
50 μm



0.75 w/o SiO_2

Microstructure of the $CuFe_2O_4$ based-ceramics.

RESULTS
(Electrical Characteristics)



Ln resistivity (ρ) vs $1/T$ of SiO_2 added- $CuFe_2O_4$ ceramics.

RESULTS
(Electrical Characteristics)

No.	Additive of SiO_2 (w/o)	B (^oK)	α (%/^oK)	ρ_{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 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 SiO_2.

  The addition of SiO_2 increased the room temperature resistivity (ρRT) and the thermistor constant (B) of the $CuFe_2O_4$ ceramics due to the segregated SiO_2.
- The value of (ρ_{RT}) and (B) of the $CuFe_2O_4$ ceramics made in this work fits the market requirement.

THANK YOU

- **ACKNOWLEGMENT**

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