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**Elaboration by sol gel method of a new oxide semiconductor of perovskite type:  $(\text{La } 2/3 \text{ Sr } 1/3 \text{ } 2 (\text{Sn } 1/3 \text{ Cu } 1/3 \text{ Fe } 1/3 \text{ } 2 \text{ O } 6)$**

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## Elaboration by sol-gel method of a new oxide semiconductor of perovskite type:



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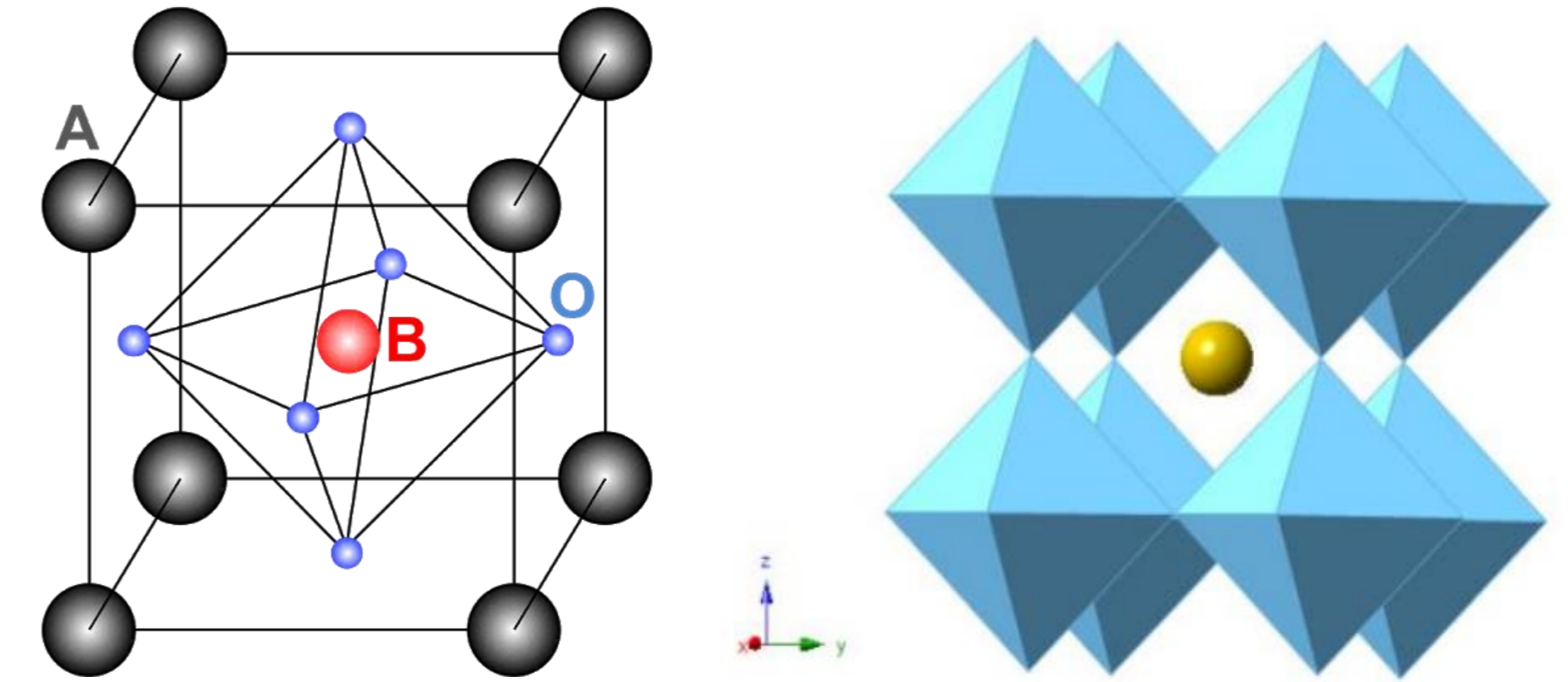
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### Background

- Perovskite named after the Russian mineralogist L. A. Perovski
- Simple and flexible structure and the simplest form is :  $\text{ABX}_3$  where A : large cation : lanthanide, alkaline or alkaline-earth type, B : small cation : transition metal and X : oxidants such as O, F, Cl
- fit to be doped with elements from all the periodic table and the combination of different elements, generate new materials, which present a wider range of physical properties.
- Low production cost
- Simple and scalable manufacturing

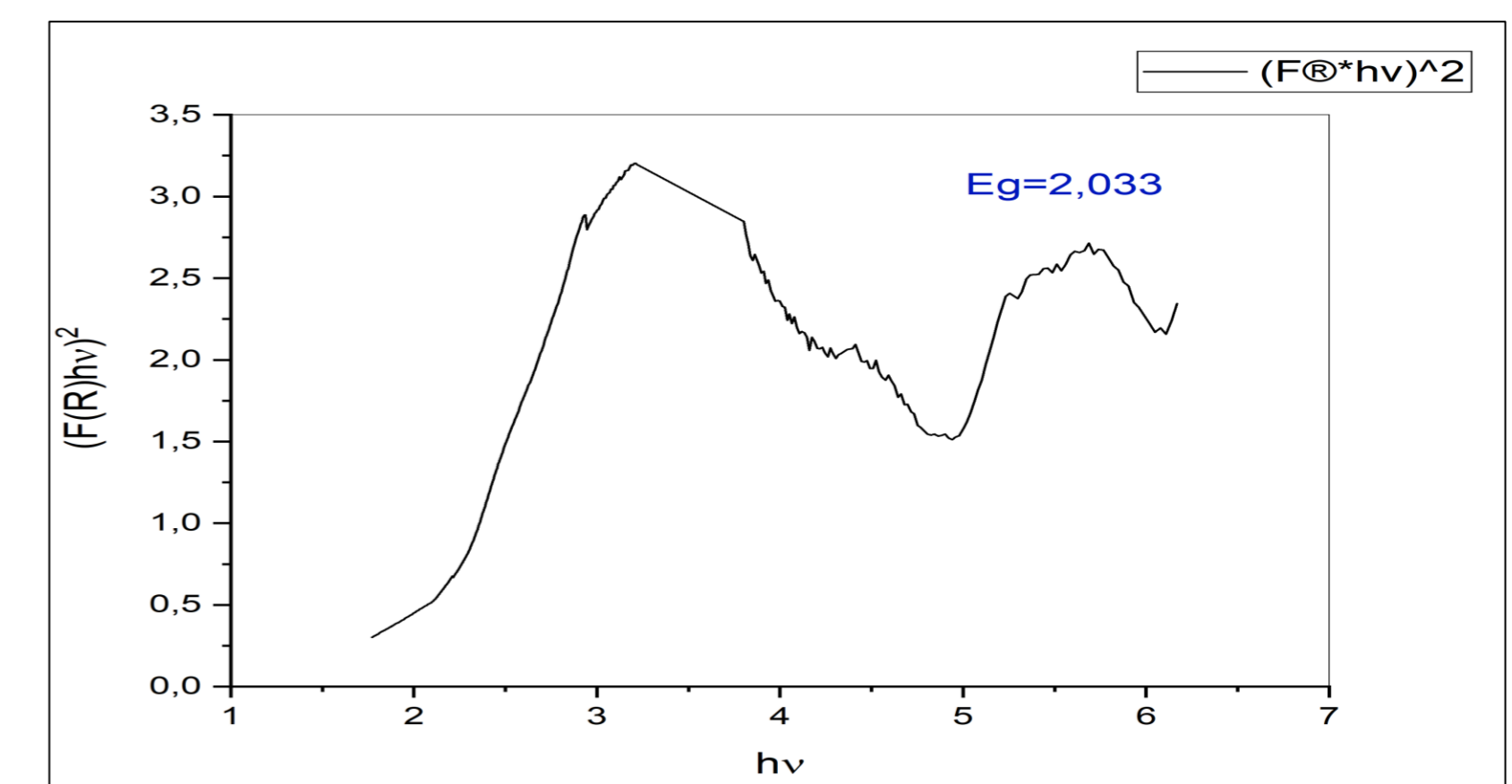


### Experimental



Figure 1 : Steps for preparing powder with sol gel method

### UV Analysis



### Structural study

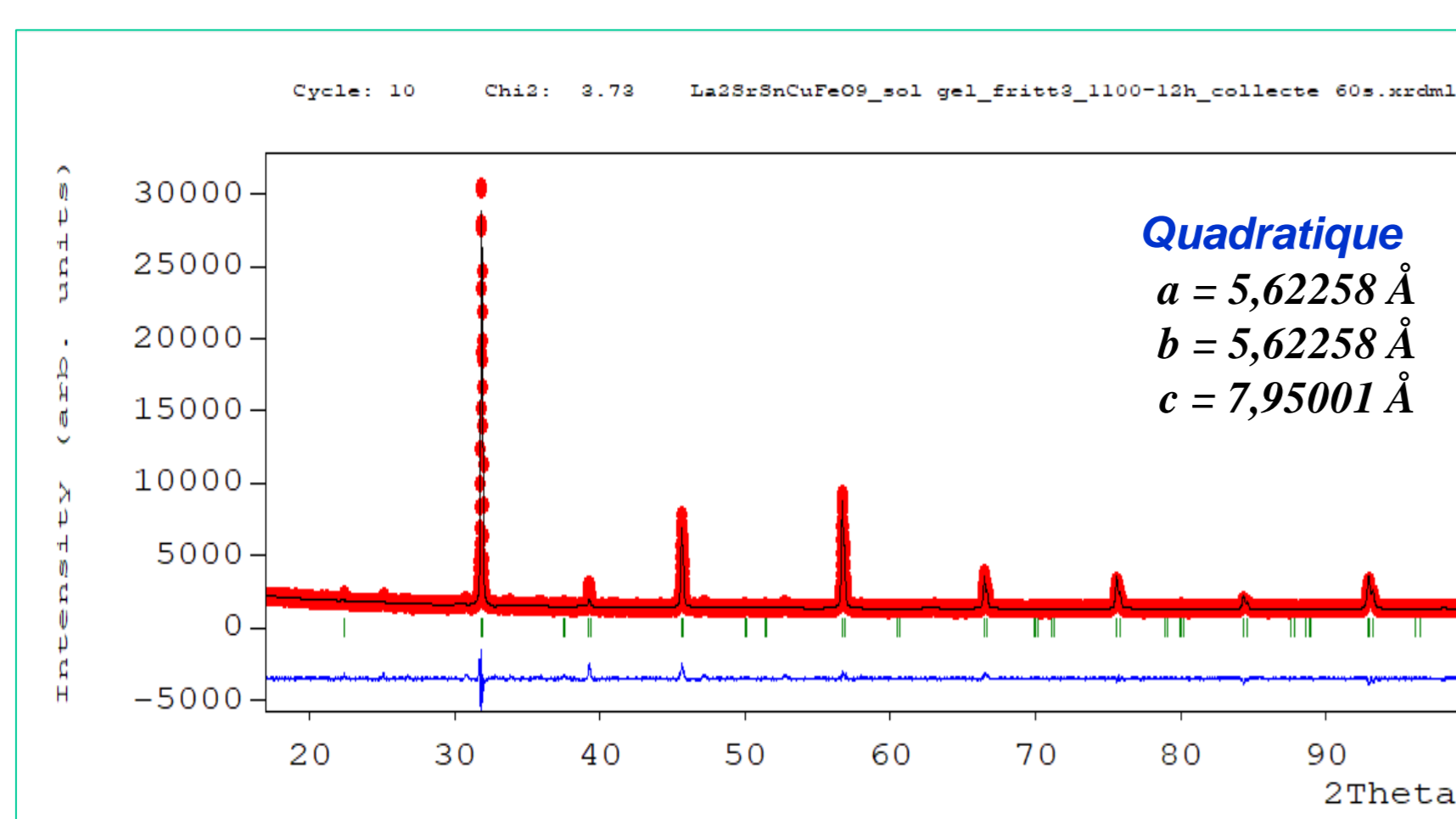


Figure 2: XRD measurement and structural refinement with Rietveld method

(La<sub>0.67</sub>Sr<sub>0.33</sub>)<sub>2</sub>(Sn<sub>0.33</sub>Cu<sub>0.33</sub>Fe<sub>0.33</sub>)<sub>2</sub>O<sub>6</sub> tetragonal I4/m space group  
 a = 5.62258(5) Å, b = 5.62258(5) Å, c = 7.95001(8) Å, V = 251.327 Å<sup>3</sup>  
 Rp = 3.401%, Rwp = 4.854%, Rexp = 2.512%, RB = 5.15%, RF = 40.7%,  
 chi<sup>2</sup> = 3.73%

Atoms	Wyckoff sites	x	y	z	occupancy	B <sub>iso</sub>
O1	4e	0	0	0.255	1	0.01235
O2	8h	0.29	0.223	0	1	-0.0444
La	4d	0	0.5	0.25	0.6666	0.02469
Sr	4d	0	0.5	0.25	0.3333	0.02469
Sn	2a	0	0	0	0.6666	0.00768
Cu1	2a	0	0	0	0.3333	0.00768
Fe	2b	0	0	0.5	0.6666	0.00172
Cu2	2b	0	0	0.5	0.3333	0.00172

Table 1 : Crystallographic data obtained from the Rietveld refinement for SrLa<sub>2</sub>CuSnFeO<sub>9</sub>

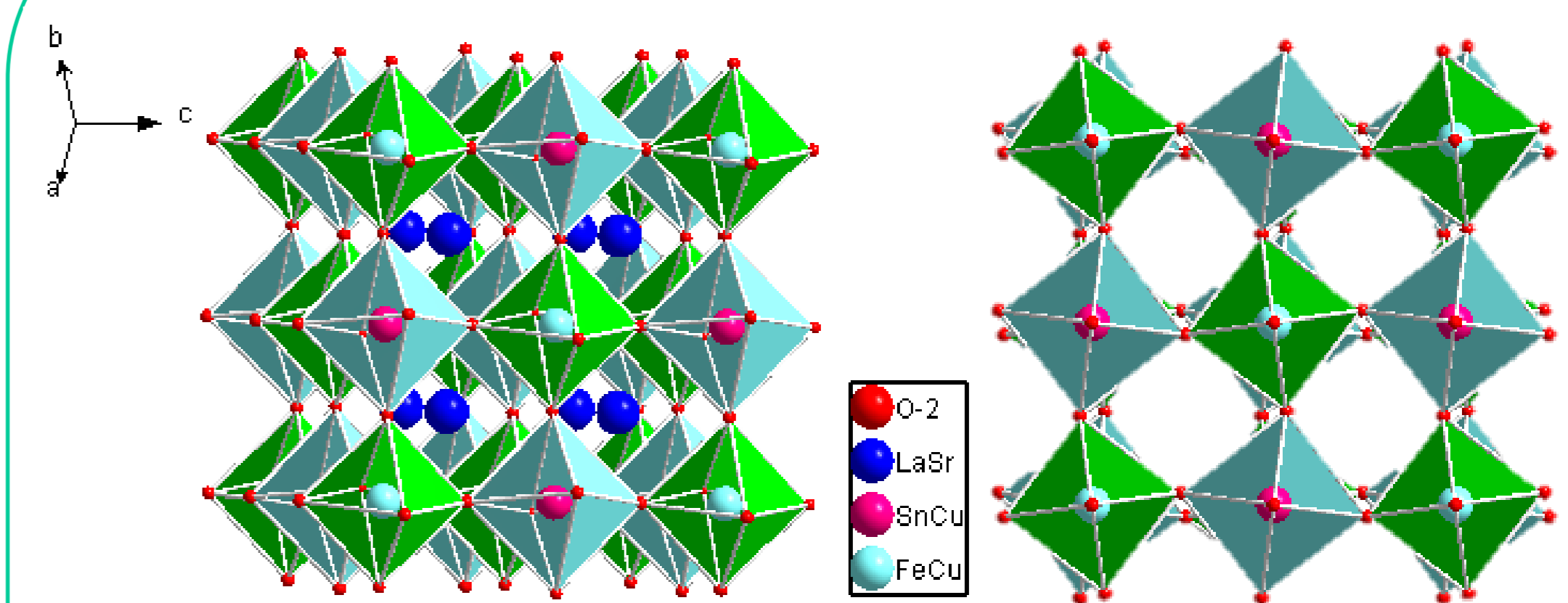


Figure 3: Schematic figure showing (Fe/Cu)O<sub>6</sub> and (Sn/Cu)O<sub>6</sub> octahedra ordered alternately in (La<sub>2/3</sub>Sr<sub>1/3</sub>)<sub>2</sub>(Sn<sub>1/3</sub>Cu<sub>1/3</sub>Fe<sub>1/3</sub>)<sub>2</sub>O<sub>6</sub> and showing octahedra distortion on the C axis

### Dielectric study

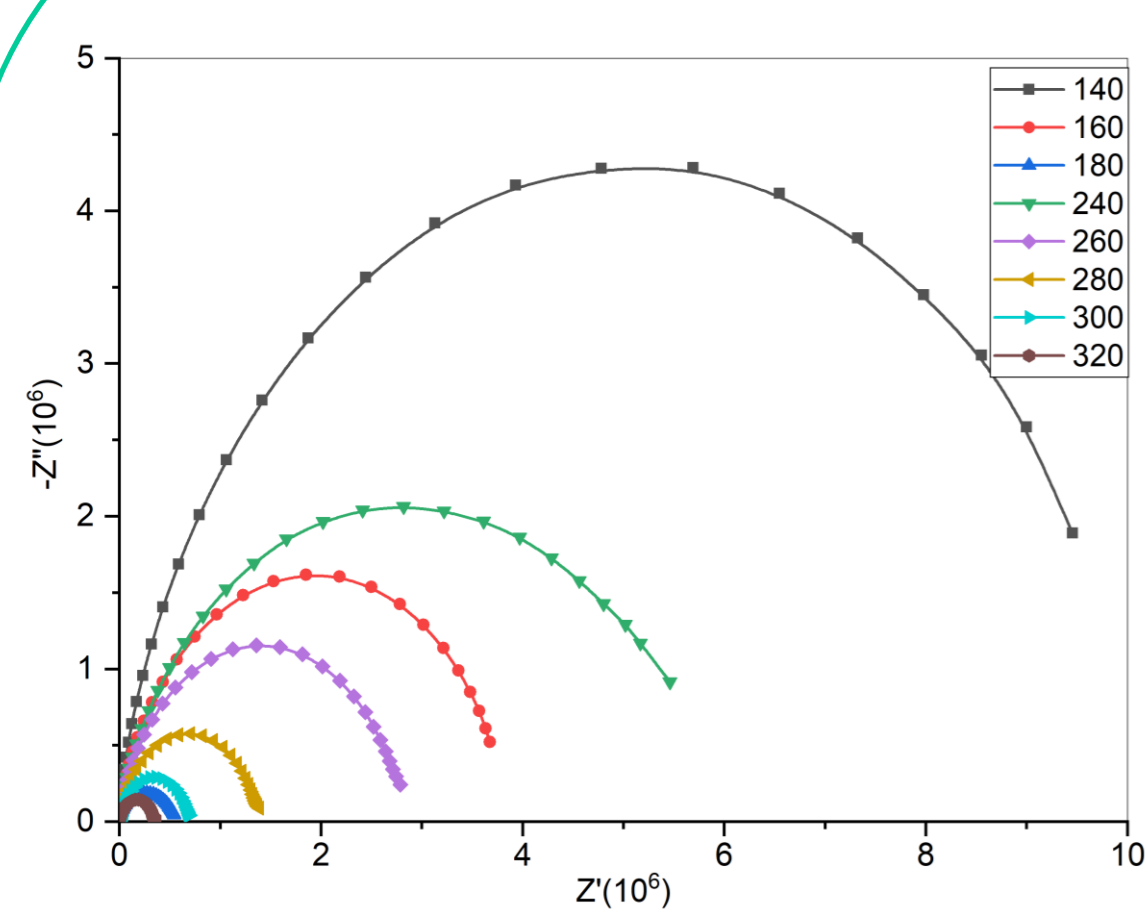


Figure 4: Nyquist plot

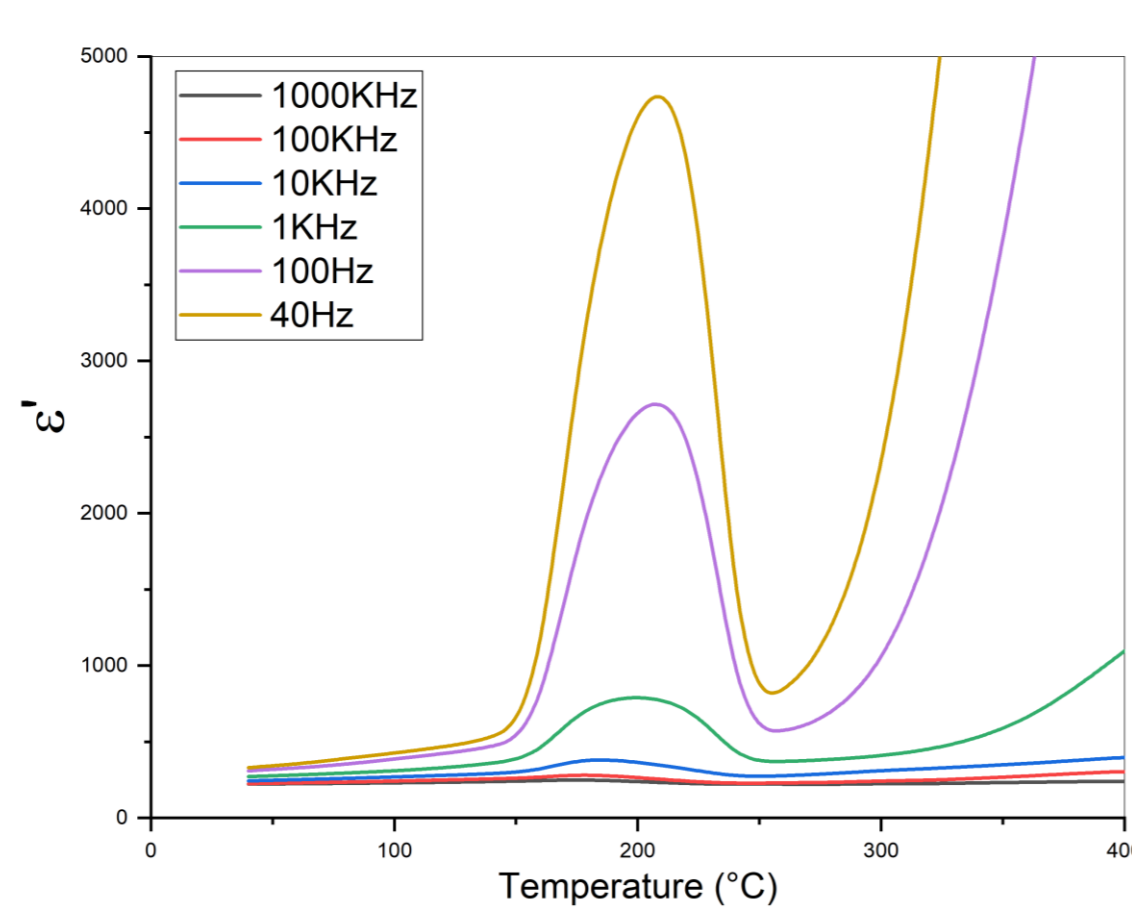


Figure 5: Variation of dielectric constant

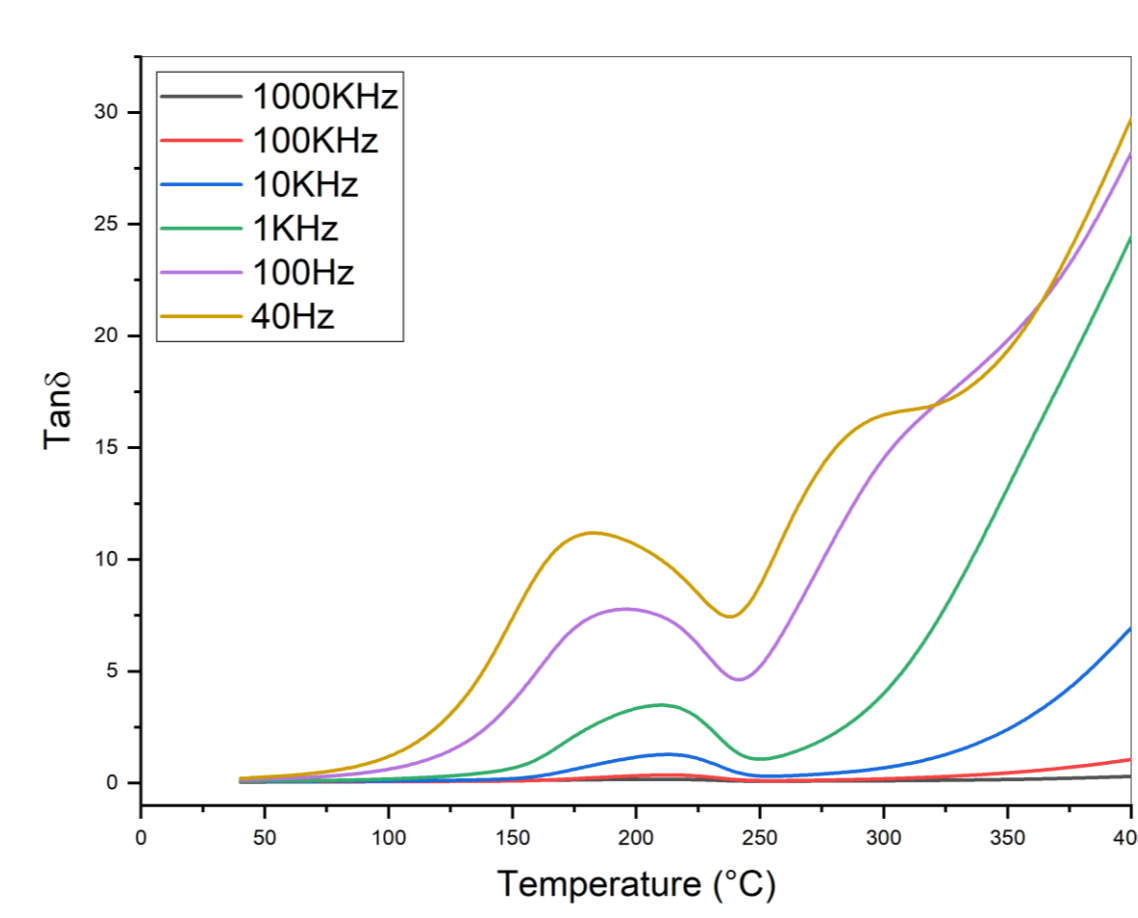


Figure 6 : Variation of Tangent loss

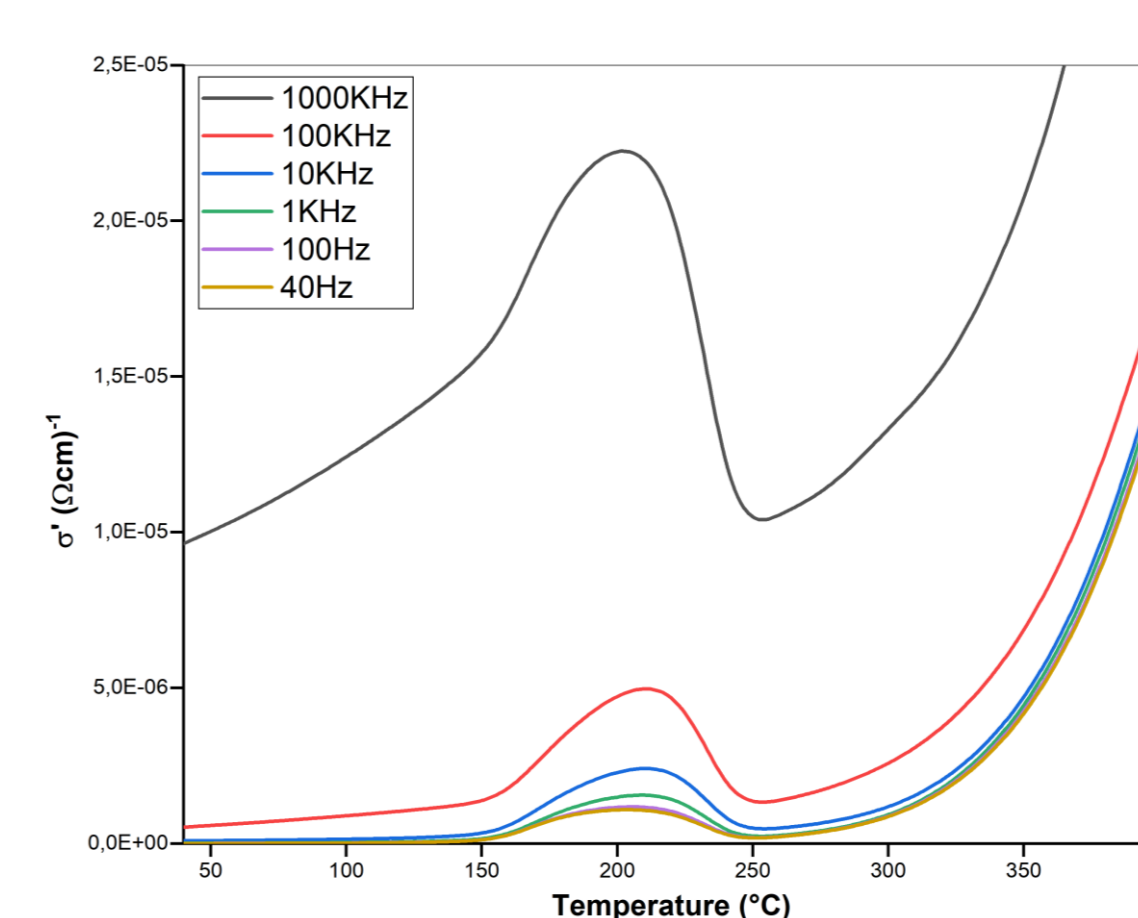


Figure 7 : Variation of Conductivity

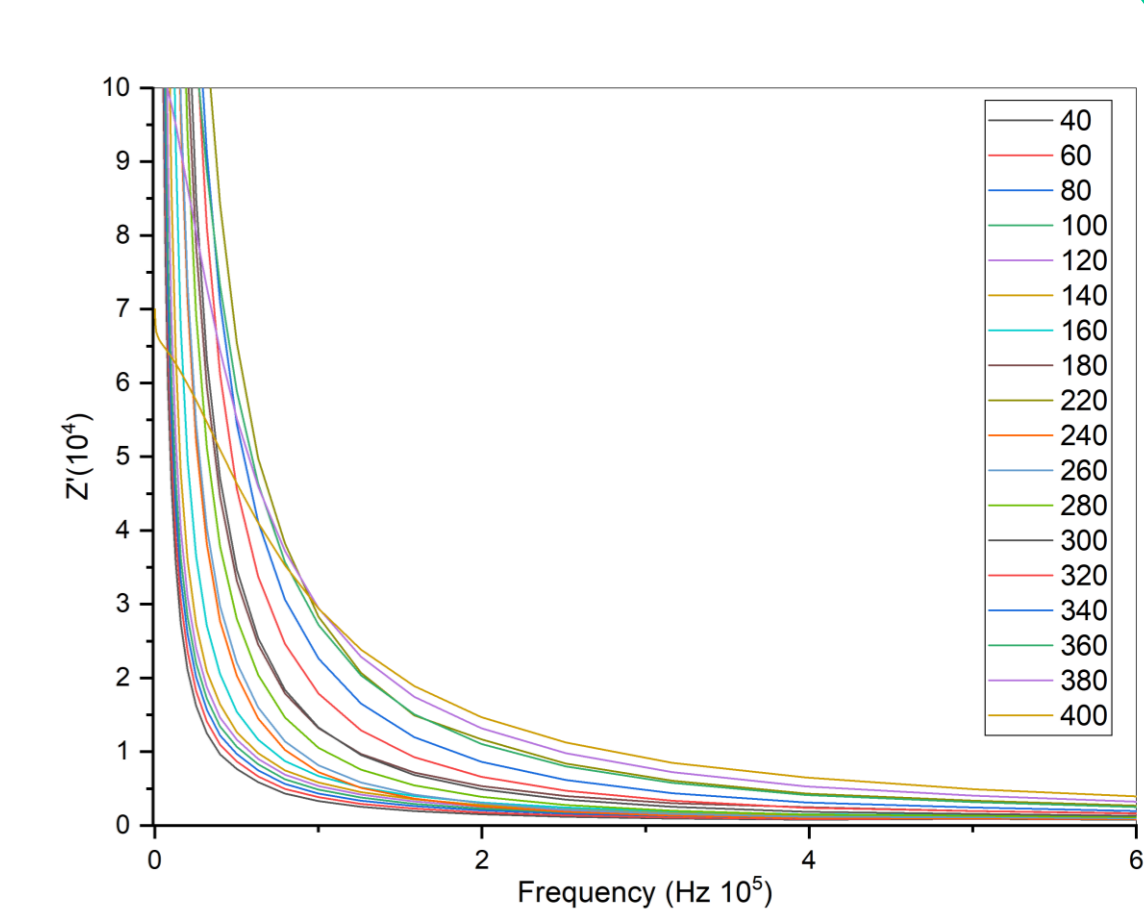


Figure 8 : Variation of Z' and -Z''

### Conclusion

- we have succeeded to synthesize new conducting material with sol-gel method
- Structure has been confirmed with XRD analysis and Rietveld Refinement
- Conductivity has been proven by the band gap calculation and dielectric study; Any increase in temperature is accompanied by a decrease in resistance and therefore an increase in conductivity, indicating that the conduction mechanism is thermally activated. This is also confirmed by the decrease in the diameters of the semi-circles with increasing temperature.