Conductive Fabrics: A New Approach to Textile Waste

Renata V. Lima[a], Camilla Boaron[a], Bruna M. Hryniewicz[b], Marcio Vidotti[a].

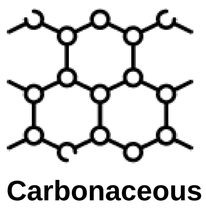
[a]Departamento de Química, UFPR, Brazil

[b]Departamento de Química, UNICAMP, Brazil

(renatalima@ufpr.br)

Introdution

Pyrolysis



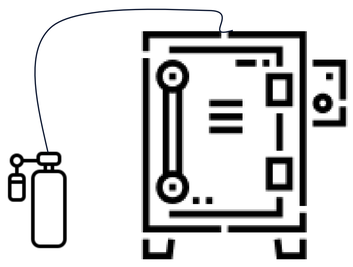
Carbonaceous structure

- Conductor material
- Flexibility
- High specific surface area
- Addition of

Experimental

Pyrolysis

Cotton fabric



CF

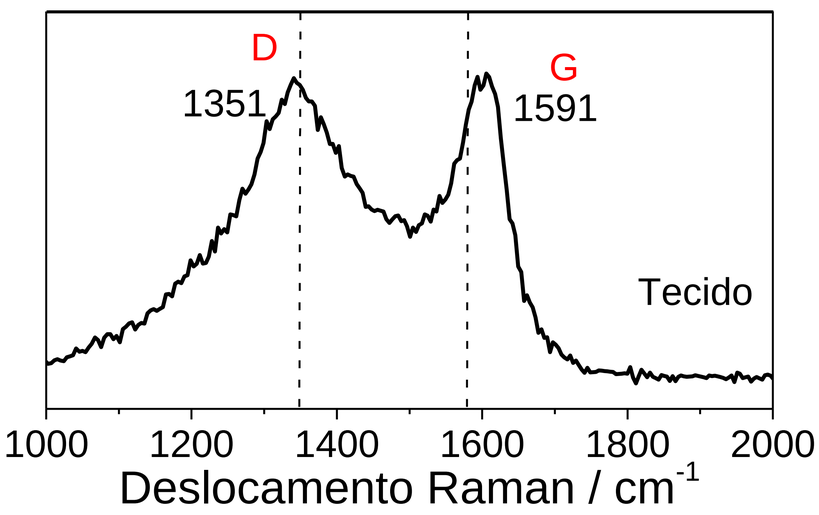
Atmosphere: N_2 and Reducing agent
Residence time: 1h – 800 ºC
Heating rate: 3 ºC/min

***CF: carbonized fabric**

Results and discussion

- Structural Characterization

Raman



- Morphological Characterizations

SEM

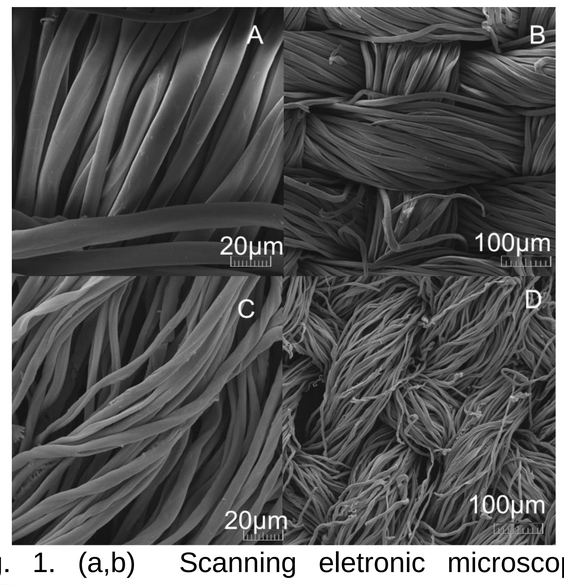
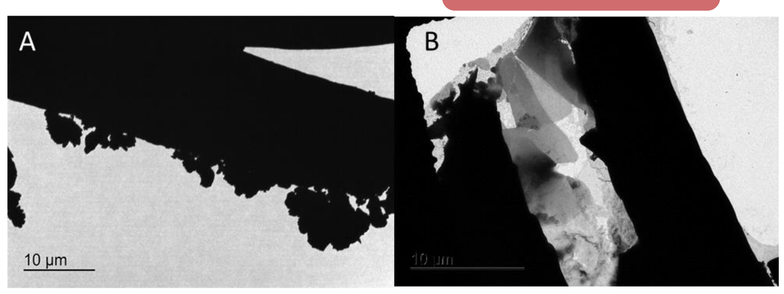


Fig. 1. (a,b) Scanning eletronic microscopy (SEM) of cotton fabric (c,d) of carbonized fabric

There was no destruction of the structure of the cotton fabric
Decrease in fiber thickness

TEM



Presence of lamellar materials, similar to the sheet structure of graphite

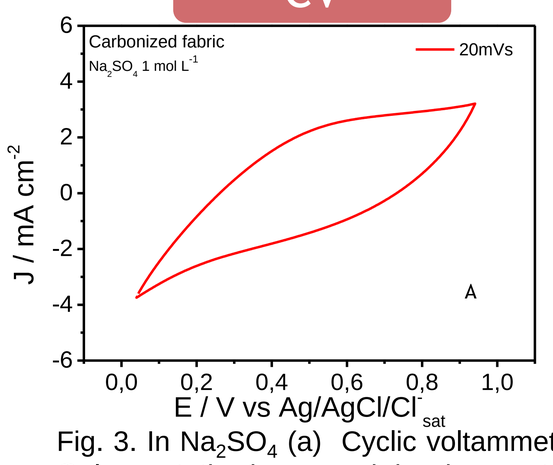
Fig. 2. (a) Transmission eletronic microscopy (SEM) of cotton fabric (b) of carbonized fabric

- Electrochemical characterization

Material	Resistence / Ω sq^{-1}
Cotton fabric	~10^{12}-10^{15}
Pyrolised fabric	174,8*

*Resistence calculated from the 4-point method

CV



GCD

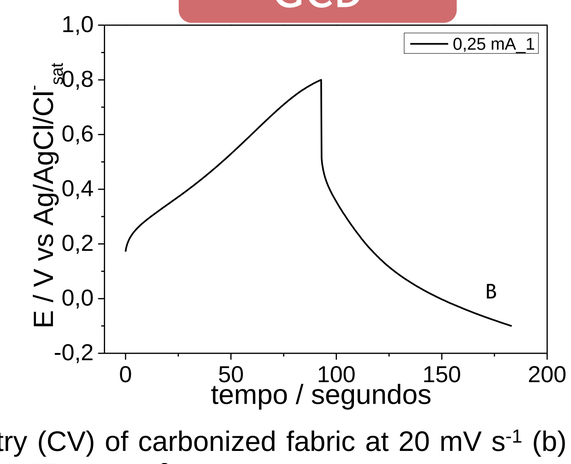


Fig. 3. In Na_2SO_4 (a) Cyclic voltammetry (CV) of carbonized fabric at 20 mV s^{-1} (b) Galvanostatic charge and descharge at 0,25 mA cm^{-2}

High capacitive current
High specific surface (BET=~433 m^2 g^{-1})
Specific capacitance: 41,6 F cm^{-2}

Conclusion

This study successfully converts textile waste into conductive materials using pyrolysis improving electrical resistance and performance in electrochemical devices like supercapacitors. It not only addresses textile waste management but also paves the way for sustainable advancements in electrochemical technology.

References

[1] Sun, C.; Li, X.; CAI, Z.; GE, F. J. E. A. Elect. Acta. v.296, p.617. 2019
[2] HAO, J.; LI, X.; LI, X.; CAI, Z.; GE, F. J. J. O. M. S. Journal of materials science Vol. 52.16

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CAPES
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