Rice Husk Waste-Derived Carbon Aerogels: A Sustainable Approach for Advanced Supercapacitor Electrodes

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Nano Innovation 2023 Conference & Exhibition — Rome, 18-22 September

Wide range of applications

- **Gas sensing**
- **Catalyst supports**
- **Adsorbents**
- **Electrodes**

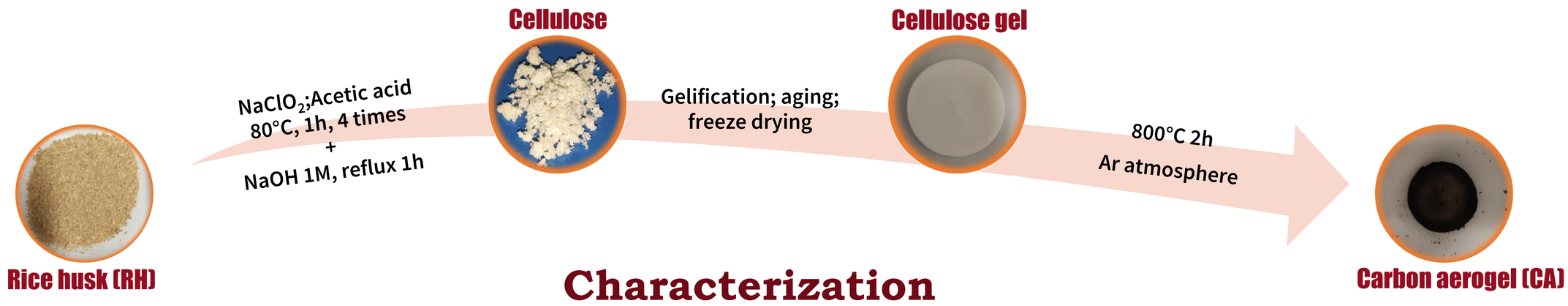
Carbon aerogels

Outstanding properties

- **High conductivity**
- **High specific surface**
- **Thermal & chemical stability**
- **Low density**

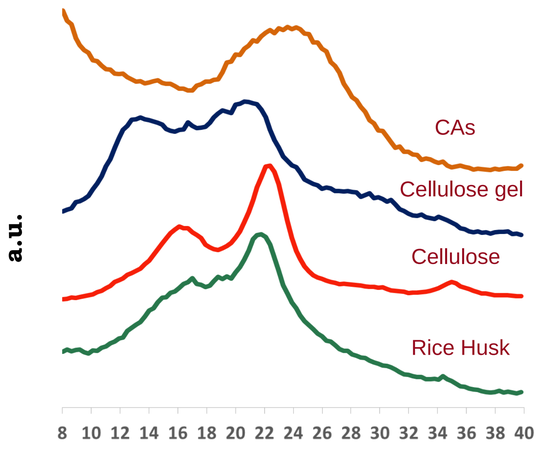
Synthesis

The two step facile synthesis removes lignin, hemicellulose and inorganic components like silica. This process allows the purification of cellulose with an average yield of 34.93% and a final yield of aerogel after carbonization around 4.50%.



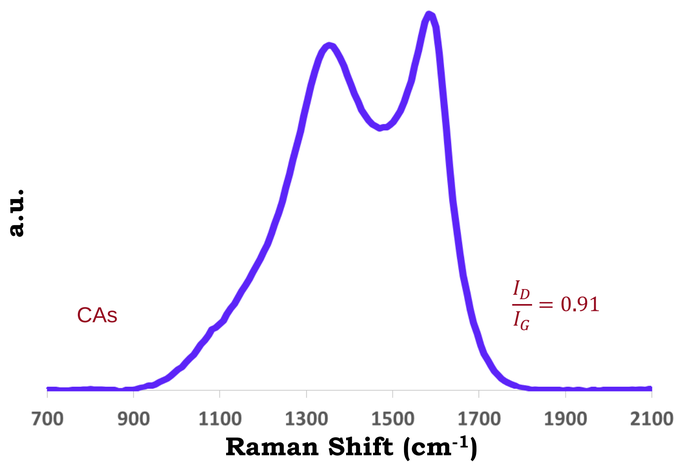
Characterization

XRD



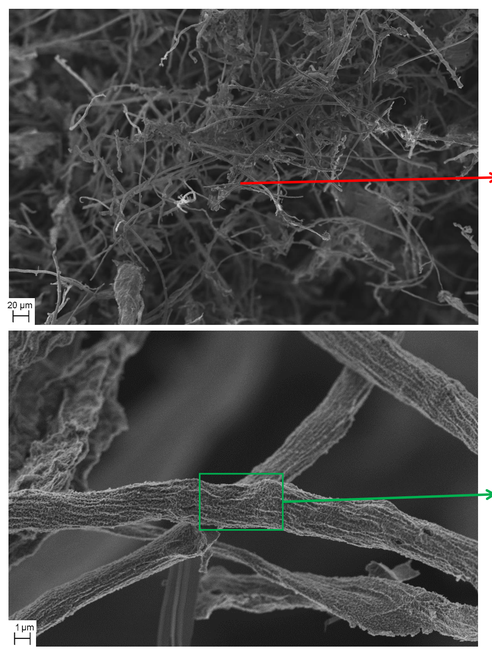
XRD analysis shows that the cellulose I structure of RH is transformed into cellulose II during gelification and in amorphous carbon after pyrolisation.

Raman Spectroscopy



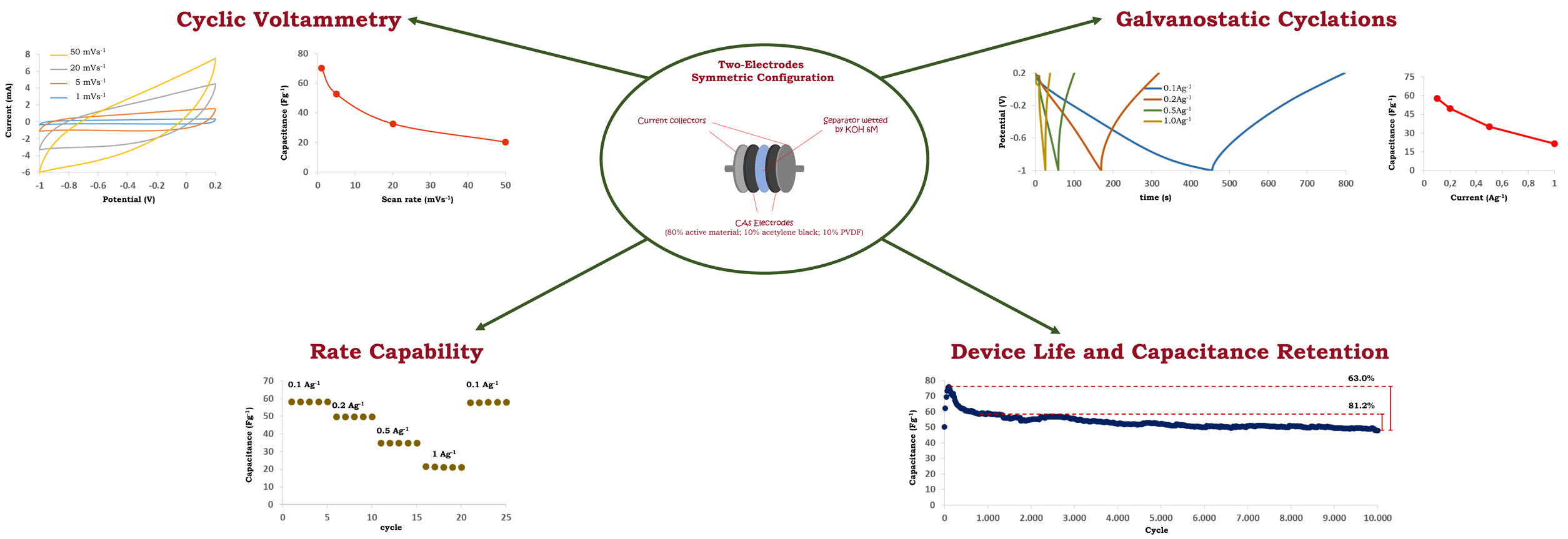
Raman Spectroscopy investigation on CAs samples shows a pattern that can be ascribed to disordered graphite.

SEM



The overall morphology of CAs is a distribution of platelets and fibers with an average diameter of 3.58±0.71μm.

Electrochemical test



Electrochemical tests on two electrodes symmetrical T-cells show that the CAs have high currents with no peaks during CV and quasi-triangular shape of discharge and charge cycles, which mean CAs have capacitive behaviour. Moreover our material can offer good capacitance with at least 61% of retention after 10'000 cycles, showing long life and resistance over time and under stress condition.

Conclusions

The possibility of fabricating a durable and stress-resistant electrode from recycling a green waste like rice husk, in a view of circular and sustainable economy, represents a remarkable synthetic opportunity. Even in preliminary results, cellulose derived CAs electrodes demonstrate high potentialities both in supercapacitors and in other electrochemical devices. Further studies are already in progress in order to overcome the limits so far observed.

Bibliography

[1] Y. Sheng; *Nanoscale*, **2020**, *12*, 19536-19556, [2] C. Tailong, *Journal of Materials Science: Materials in Electronics,* **2018**, *29*, 4334–4344, [3] L. Jong-Hoon; *Carbon, **2020**, 163*, 1-18, [4] Z. Zhang; *J. Phys. Chem. C, **2019**, 123, 38,* 23374–23381