NITROGEN-DOPED CARBON FOR SUPERCAPACITORS: SYNTHESIS, PROPERTIES AND APPLICATIONS

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The key to success in increasing the specific capacity of nanoporous carbons, which are used for the manufacture of supercapacitor electrodes, is to ensure the combination of optimal porous structure with the appropriate electronic structure of the material. This would ensure the release of the Helmholtz capacitance by the capacitance of the space charge region in the solid. Therefore, the aim of this work was to obtain nitrogen-doped environmentally safe nanoporous carbon material.

Nitrogen-containing carbon material was obtained by direct pyrolysis method. Glucose was used as a carbon source, sodium bicarbonate as an activator (porogen) and urea as a nitrogen source for carbon doping.

Methods of investigation:

- ***Scanning electron microscopy***
- ***X-ray diffractometry and small-angle X-ray scattering***
- ***Impedance spectroscopy***
- ***Chronopotentiometry methods***

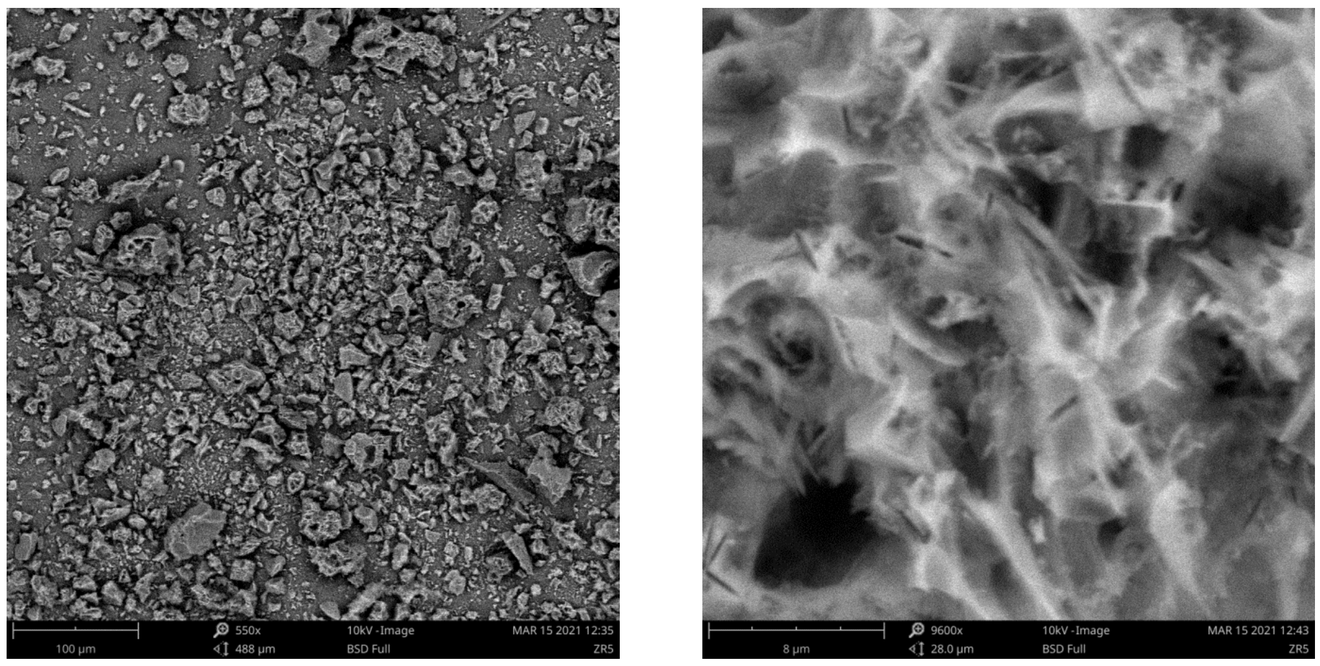
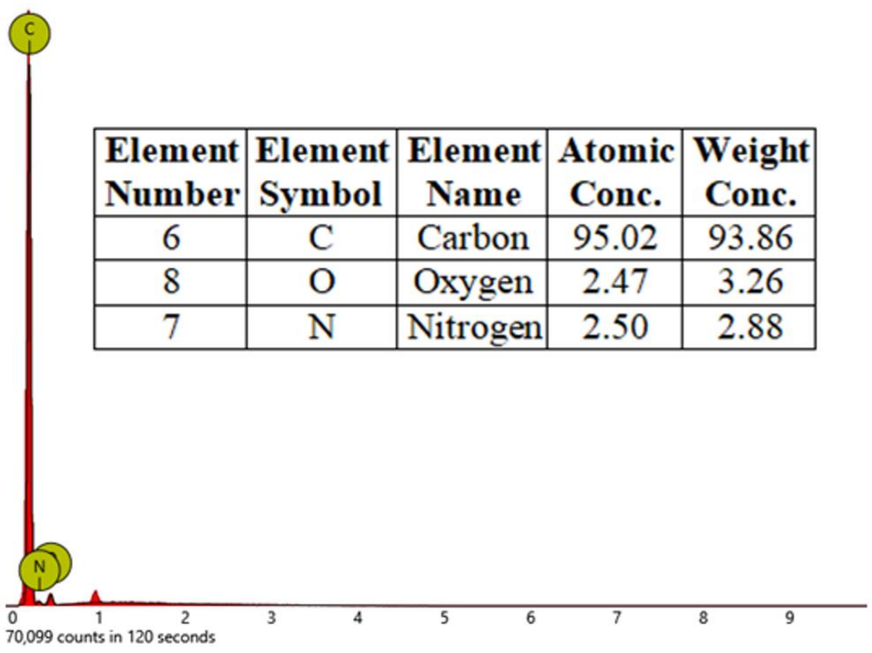


Figure 1. SEM image of the synthesized carbon.



Element Number	Element Symbol	Element Name	Atomic Conc.	Weight Conc.
6	C	Carbon	95.02	93.86
8	O	Oxygen	2.47	3.26
7	N	Nitrogen	2.50	2.88

Figure 2. EDS analysis of the synthesized carbon.

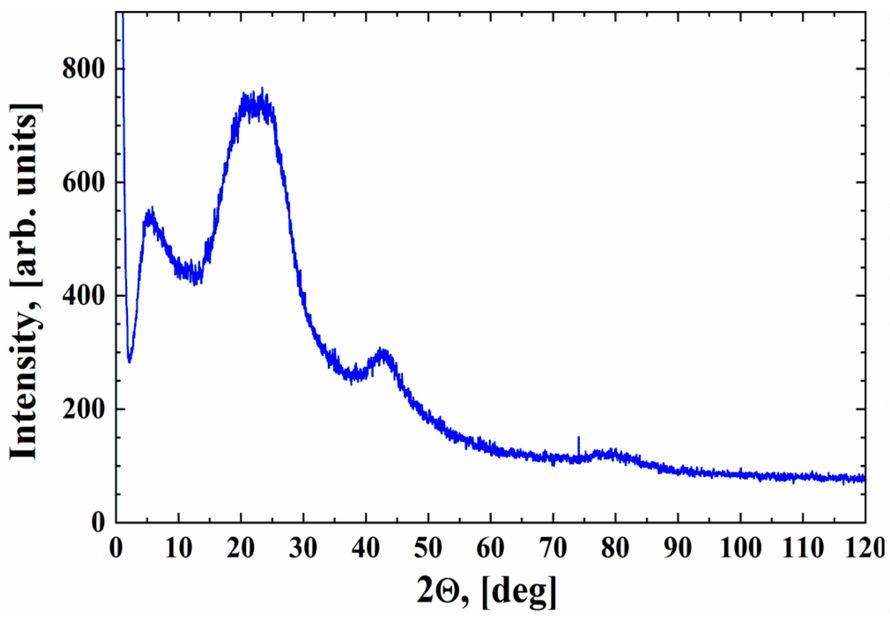


Figure 3. X-ray diffraction pattern of the synthesized carbon.

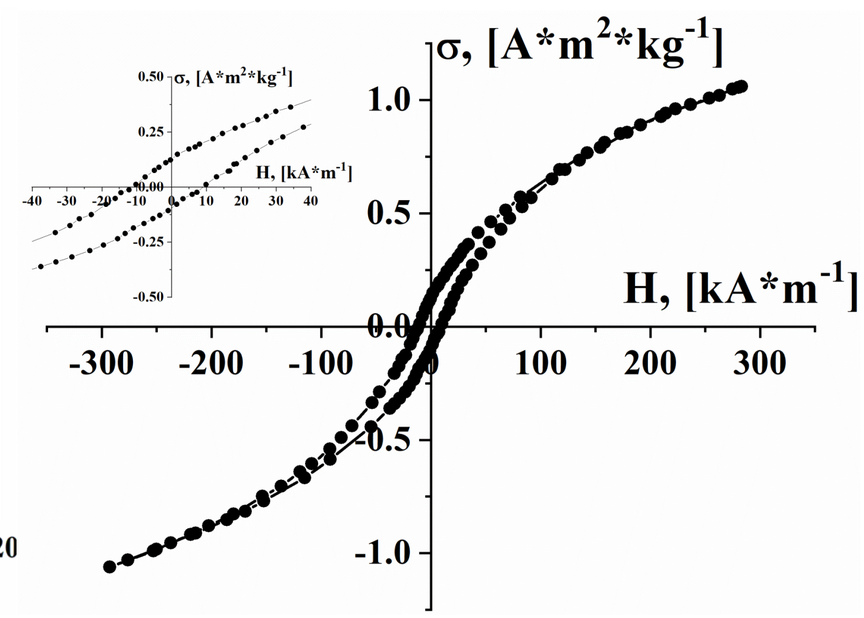


Figure 4. The hysteresis loop of the magnetic moment of synthesized carbon. On the insert is the region of small values of the magnetic field strength.

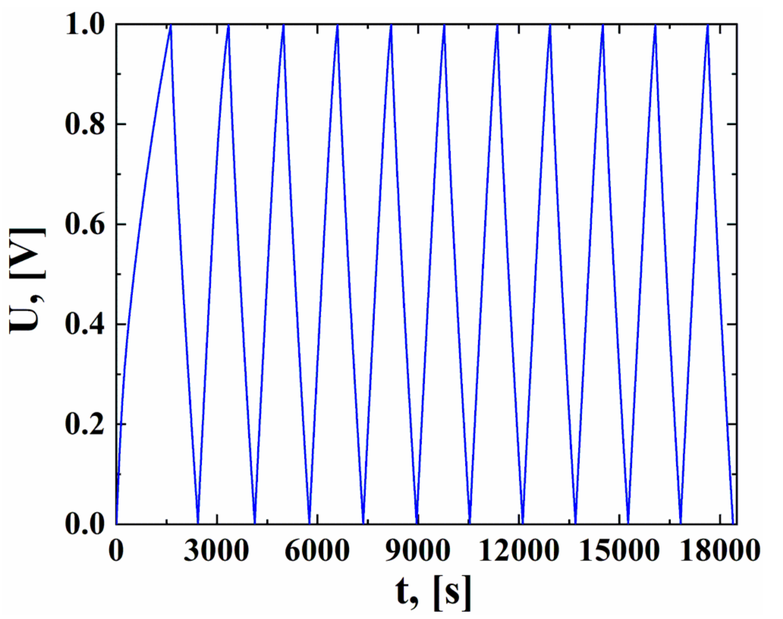


Figure 5. Galvanostatic charge-discharge curves of synthesized carbon.

CONCLUSIONS

1. **The resulting carbon material is characterized by high homogeneity as evidenced by the images taken on the Phenom ProX scanning electron microscope. The nitrogen content of the EDS analysis system ranged from 2.88% to 25.17 wt.%.**
2. **According to the results of nitrogen adsorption-desorption received the maximum pore distribution in the radius corresponds to 1.42 nm, and the total surface area reaches 1247 m^2/g.**
3. **The method of vibration magnetometry established that the specific saturation magnetization of carbon material in the magnetic field strength of 800 kA/m is σ_s= 1.4 $A \cdot m^2 \cdot kg^{-1}$, and the coercive force H_c= 10 kA/m.**
4. **It was found that in a symmetrical supercapacitor with 30% water solution KOH electrolyte, the specific capacity of the obtained carbon material reaches 180 F/g, which is 80% higher compared to the existing on the market materials.**