STRUCTURAL BATTERIES: DESIGNING SOLID POLYMER ELECTROLYTES AND ELECTRODES

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INTRODUCTION

The current era requires environmentally friendly energy storage solutions. Structural batteries, which function both as structural components and electrochemical energy storage units, are in high demand. Carbon-fiber reinforced polymer (CFRP) composites possess remarkable in-plane mechanical and electrical properties, making them suitable for battery applications. This research explores the design and development of CFRP composites as electrodes, and evaluates the performance of reference CFRP compared to modified CFRP with plasticizer (PL) (mCFRP) and with PL-functionalized carbon nanotubes (f-CNTs-PL). The study provides valuable insights into the benefits of multifunctional CFRP materials.

METHODOLOGY

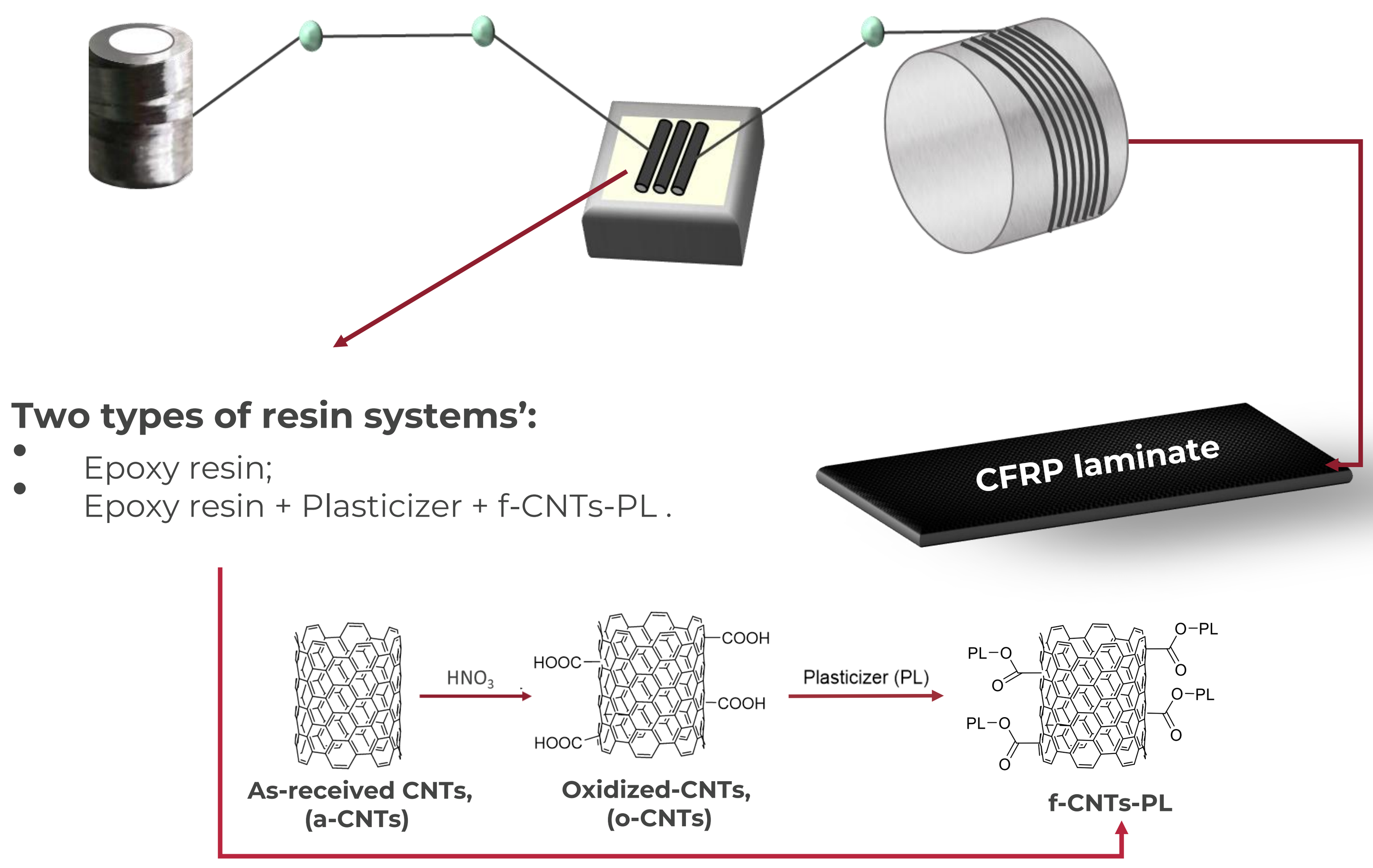

Fig. 1 – Schematic representation of the developed methodology in this work.

RESULTS AND DISCUSSION

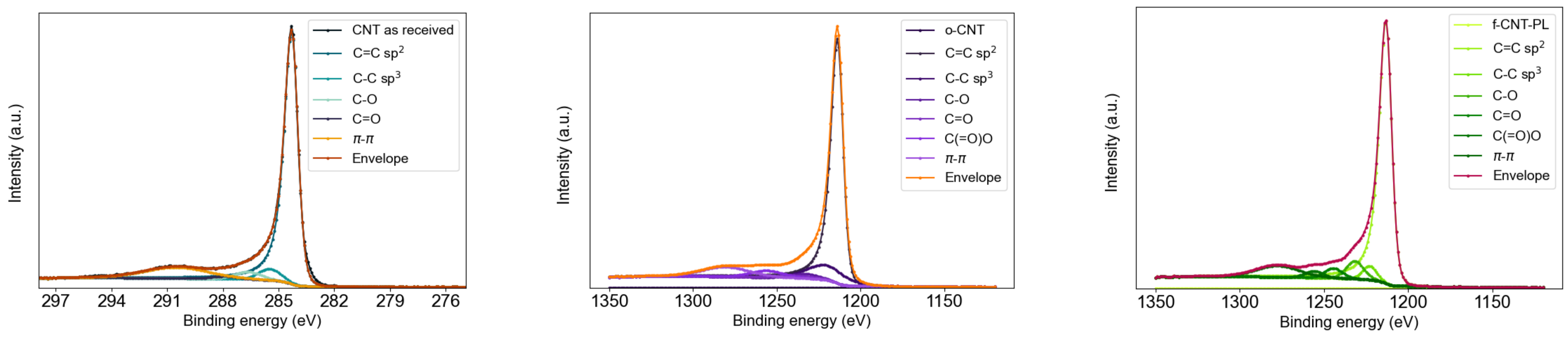

Fig. 2 – XPS spectra of a-CNTs, o-CNTs and f-CNTs-PL.

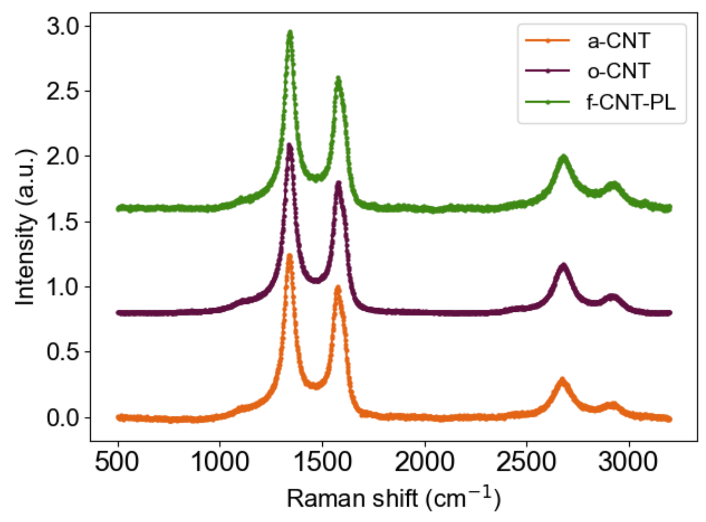

Fig. 3 – Raman spectra of a-CNTs, o-CNTs and f-CNTs-PL..

Table 1 – Surface chemical elemental composition of the a-CNTs, o-CNTs and f-CNTs-PL.

	XPS atomic composition (at%)		Atomic ratio (%)	Raman
	C 1s	**O 1s**	**O/C**	**I_D/I_G**
a-CNTs	99.5	0.50	0.5	1,22 ± 0.07
o-CNTs	97.1	2.90	2.9	1,27 ± 0.04
f-CNTs-PL	96.3	3.70	3.8	1,30 ± 0.03

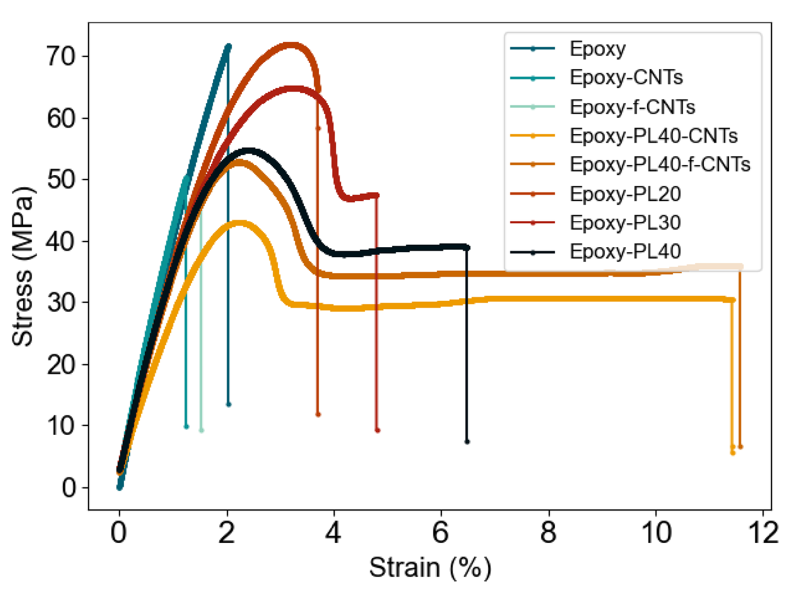

Fig. 4 – Mechanical tests of different matrix formulations.

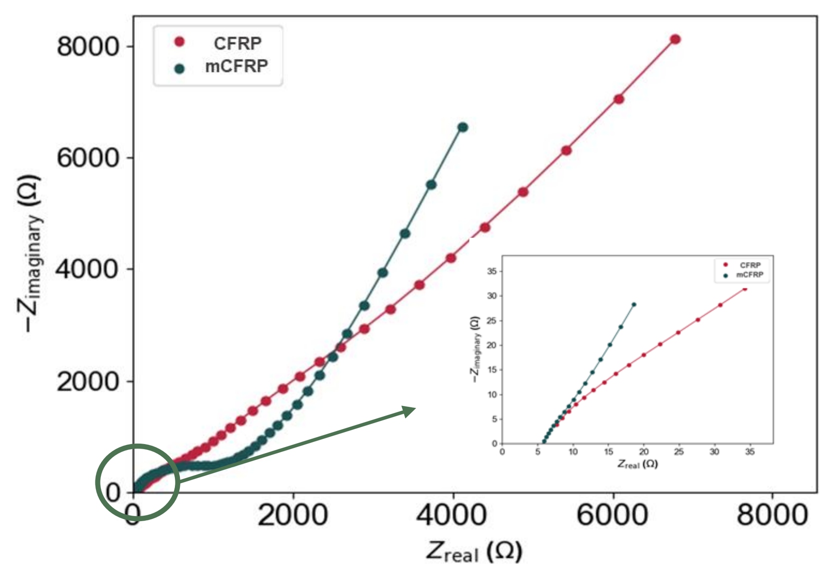

Fig. 5 – EIS measurements of CFRP and modified CFRP (mCFRP).

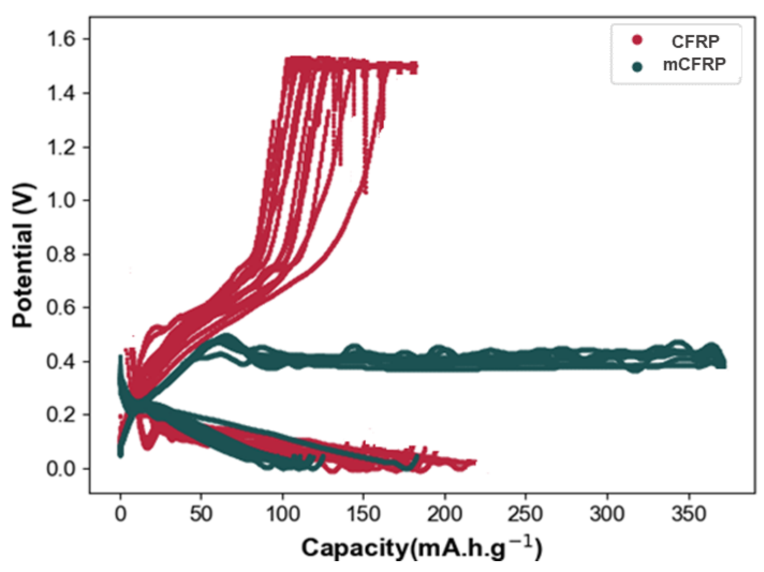

Fig. 6 – Galvanostatic charge and discharge cycles of CFRP and modified CFRP (mCFRP).

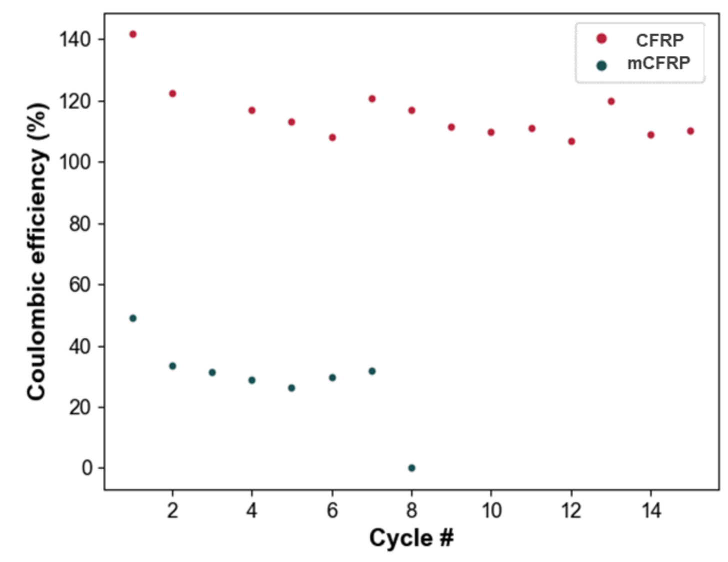

Fig. 7 – Coulombic efficiency obtained at each cycle of CFRP and modified CFRP (mCFRP).

CONCLUSIONS AND ON-GOING WORK

- The functionalization of CNTs and the modification of CFRP composites were accomplished with success.
- It is crucial to find a good compromise between the mechanical and electrochemical properties; a capacity review is required due to Coulombic efficiency exceeding 100%.
- Ongoing investigation on the impact of modifications; modified CFRP showed superior mechanical characteristics.

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