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Introduction

In the last decades, Conducting Polymers (CPs) triggered the interest of the scientific community towards their potential use as electro-active materials in a variety of organic electronic devices (OEDs), such as sensors, organic electronic transistors (OECTs), organic memristive devices (OMDs), organic photovoltaic cells (OPVs), and so on [1-3].

Aim of the work

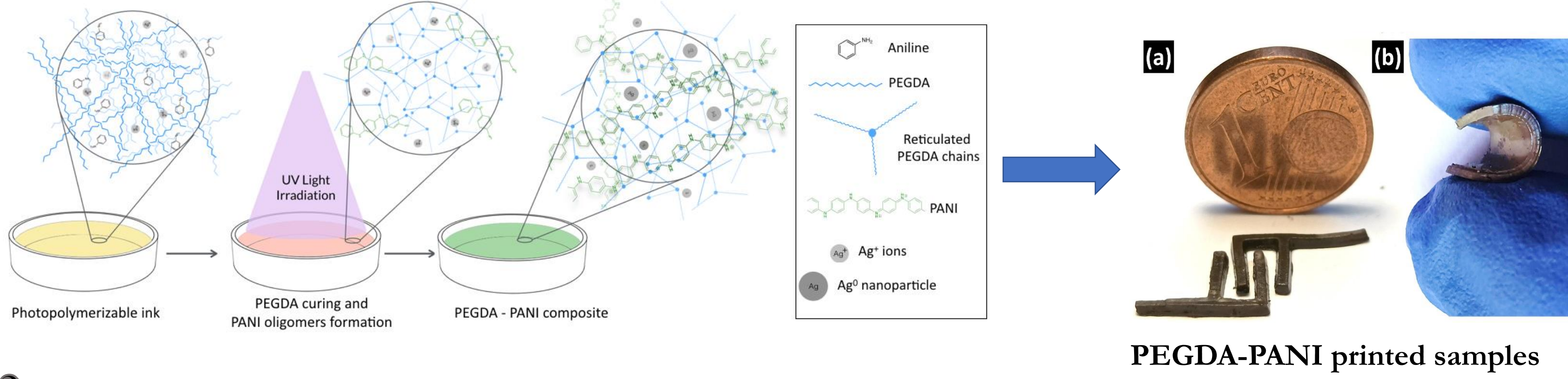
The present contribution is focused on the exploration of CPs for the design, synthesis, fabrication and characterization of new types of 2D and 3D OEDs.

3D systems

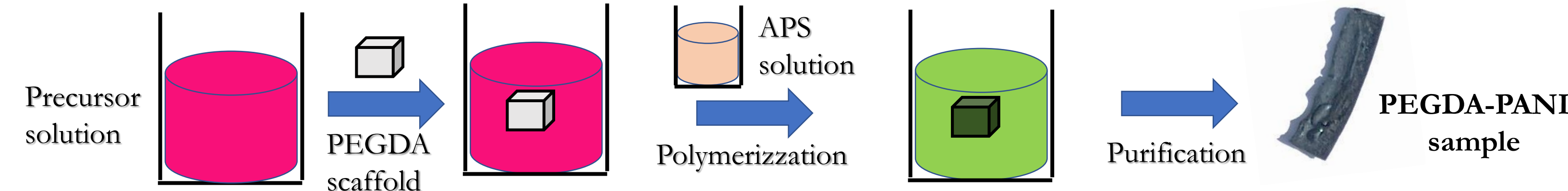
Experimental

Polyethylene glycol diacrylate (PEGDA) – Polyaniline (PANI) objects were produced by using commercial ELEGOO Mars MSLA printer by two routes:

1. Photopolymerization of aniline directly during the 3D printing process



2. In-situ polymerization of dianiline precursor

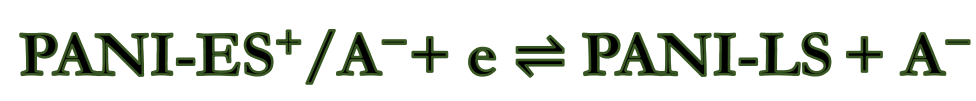


Characterizations

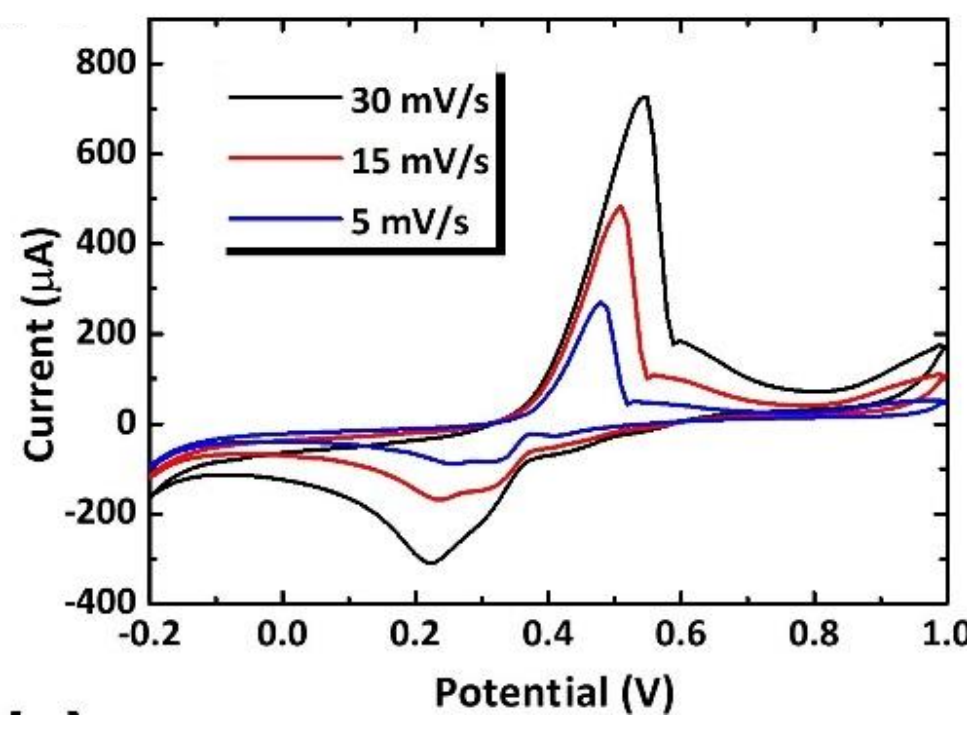
Cyclic Voltammetry curves in HCl 1M for:

The CV curves indicate a complexity of the redox reactions within PEGDA. The redox pathway proposed for the conformational changes of the PANI chains in the anion exchange.

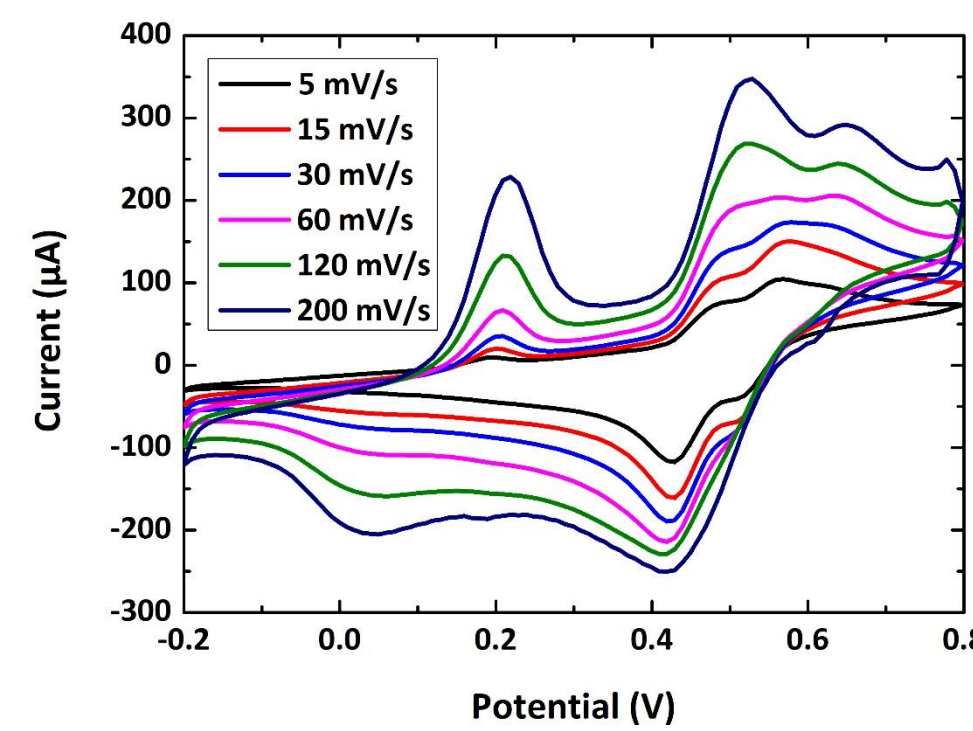
SMALL ANIONS:
ANION EXCHANGE



1. PEGDA-PANI samples by photopolymerization



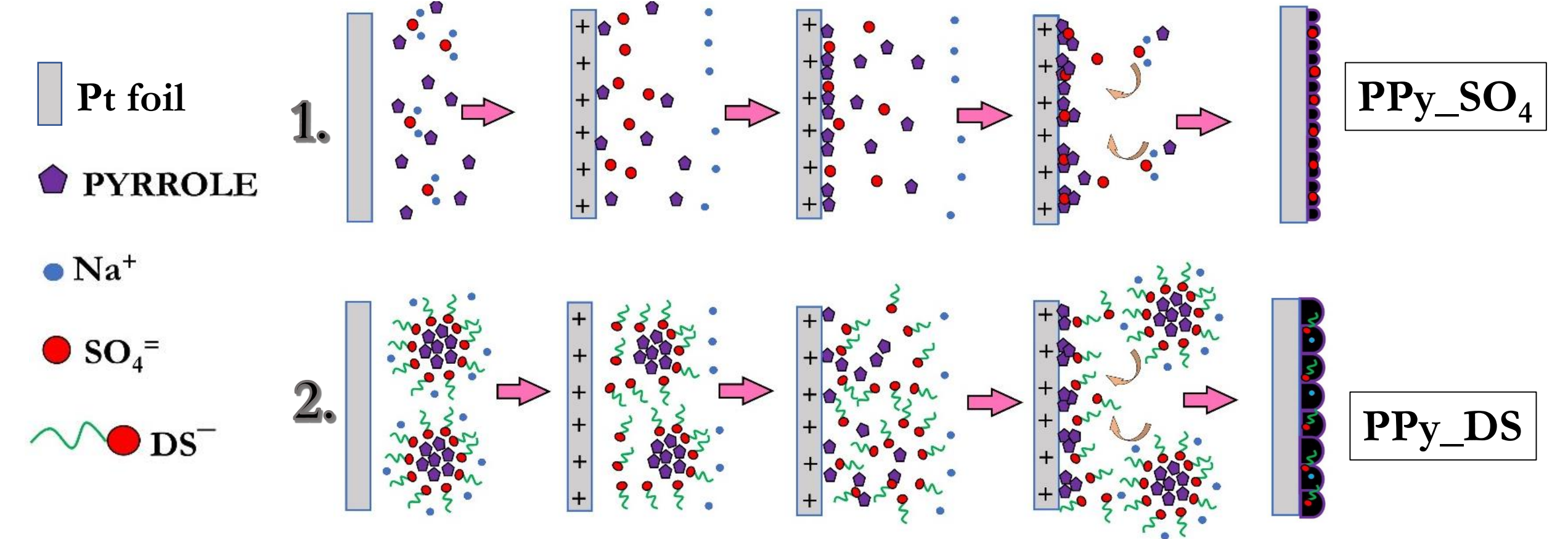
2. PEGDA-PANI samples by in-situ polymerization



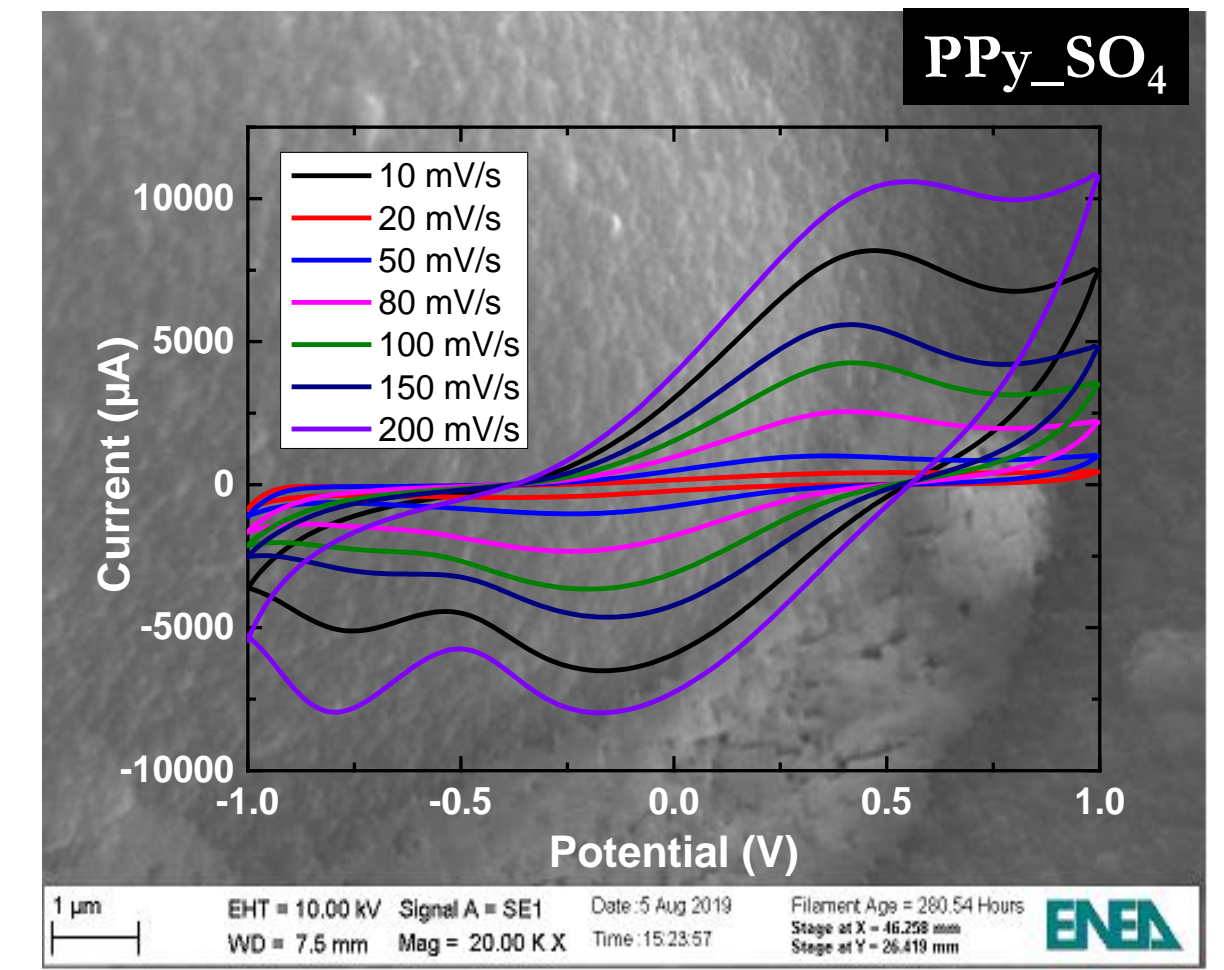
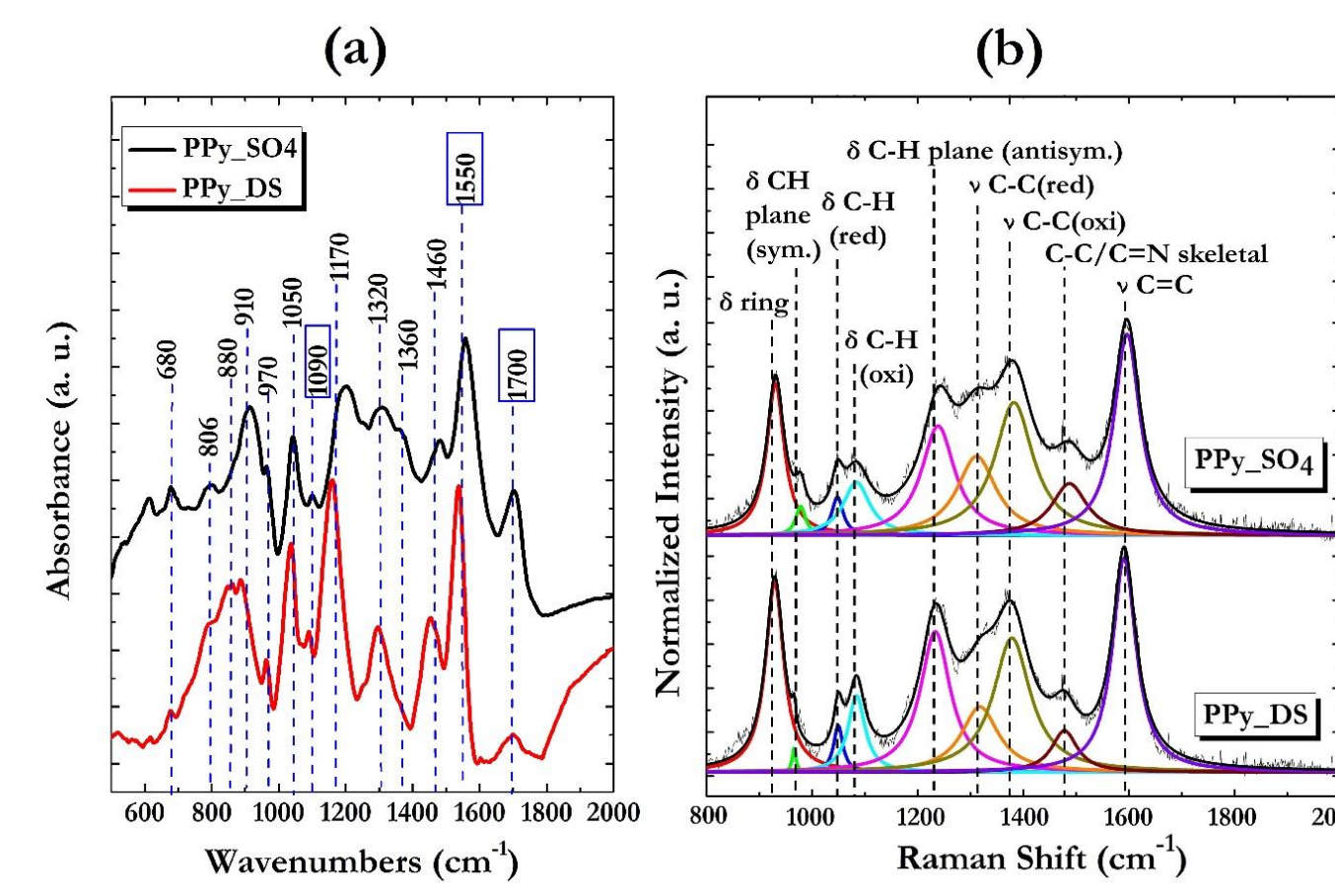
2D systems

Experimental

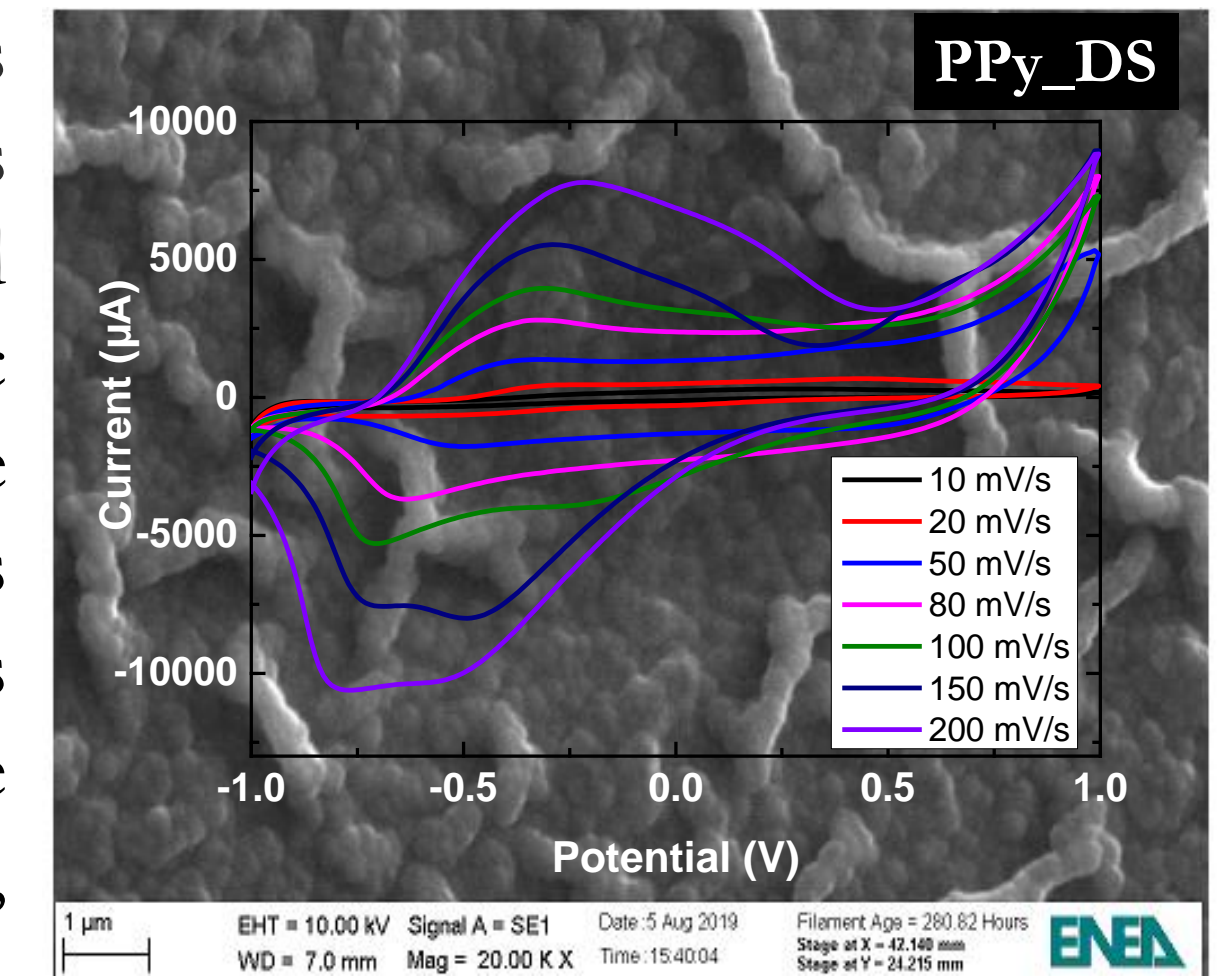
Sulphate (SO_4^{2-}) or dodecyl sulphate (DS^-) doped polypyrrole (PPy) films are produced on Pt foils by chronoamperometry technique [4].



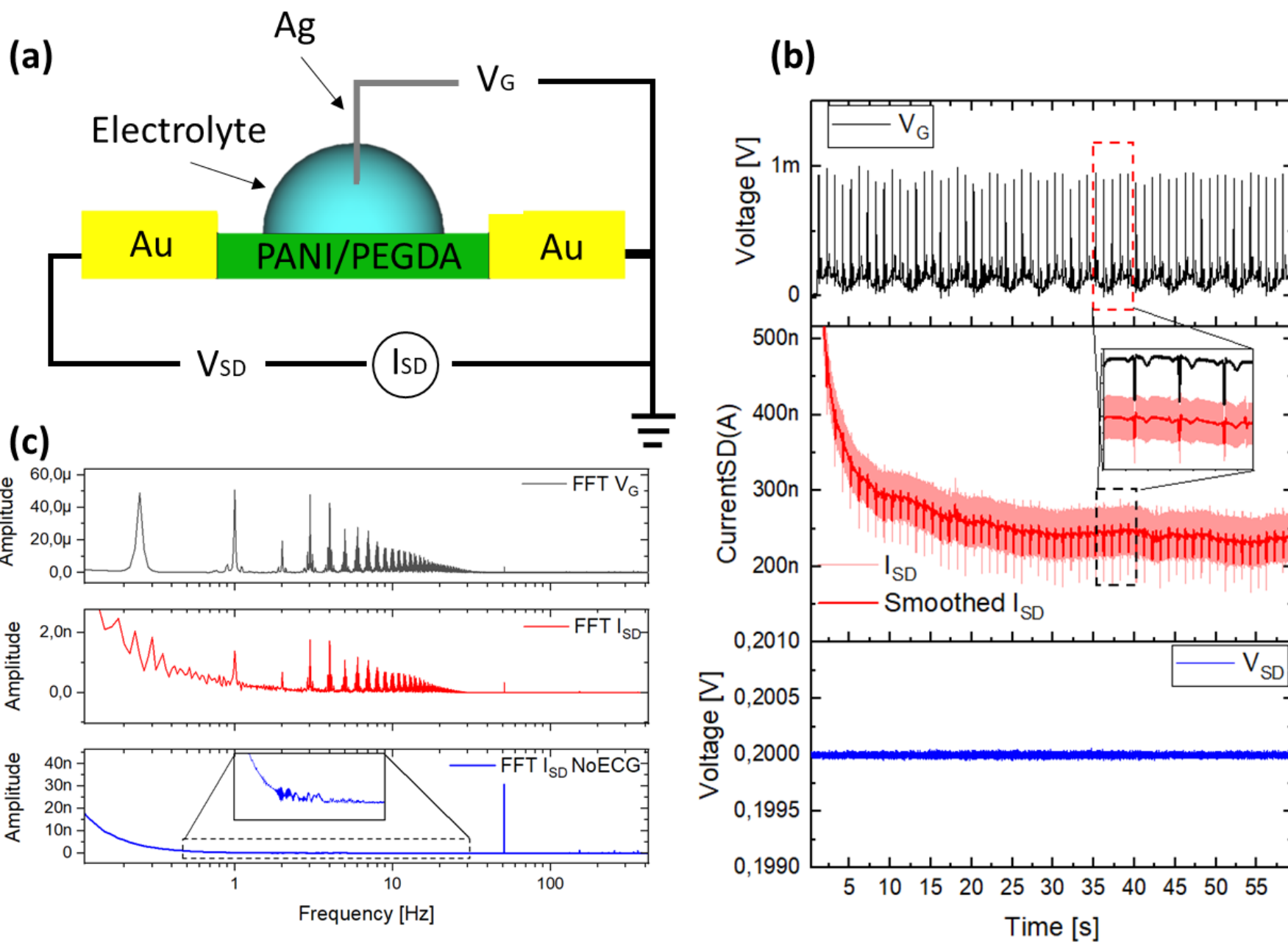
Characterizations



IR, Raman spectra and SEM images disclose that the nature of counterions incorporated in the polymeric matrix is crucial for the structural and morphological features of the polymeric films. The possible changes involving the polymer matrix during the CV processes can be described by the pathways involving anionic and cationic exchange for PPy_SO4 and PPy_DS films, respectively.



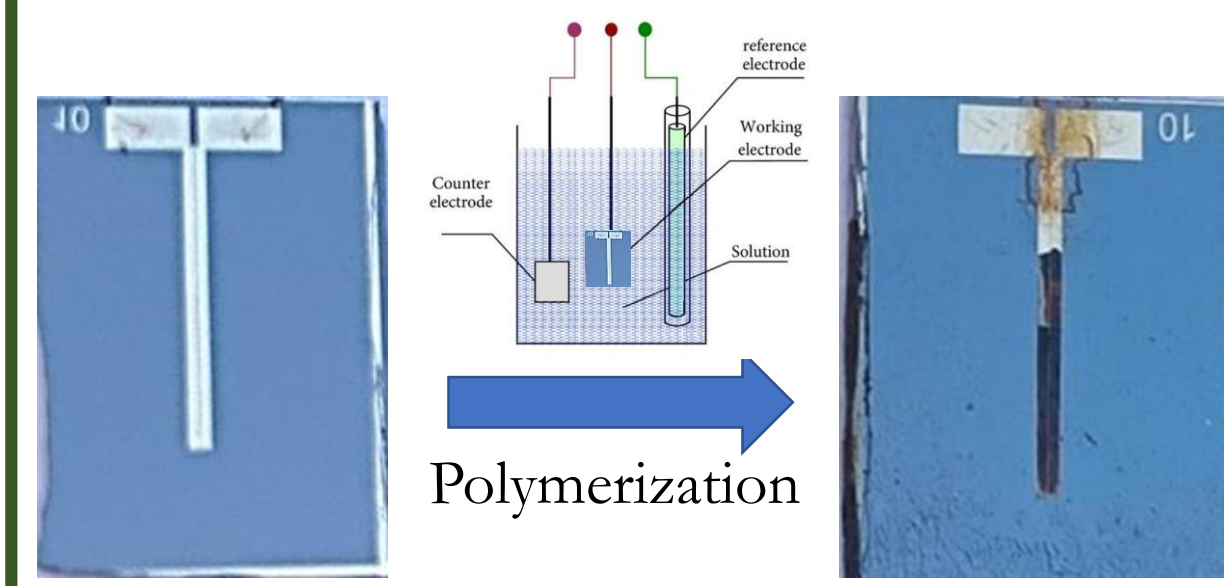
Application



The electrical response of the so realized PEGDA-PANI materials is susceptible to small and fast oscillations of biosignals that it is able to accurately replicate even if stimulated by the application of a relatively low amplitude bias.

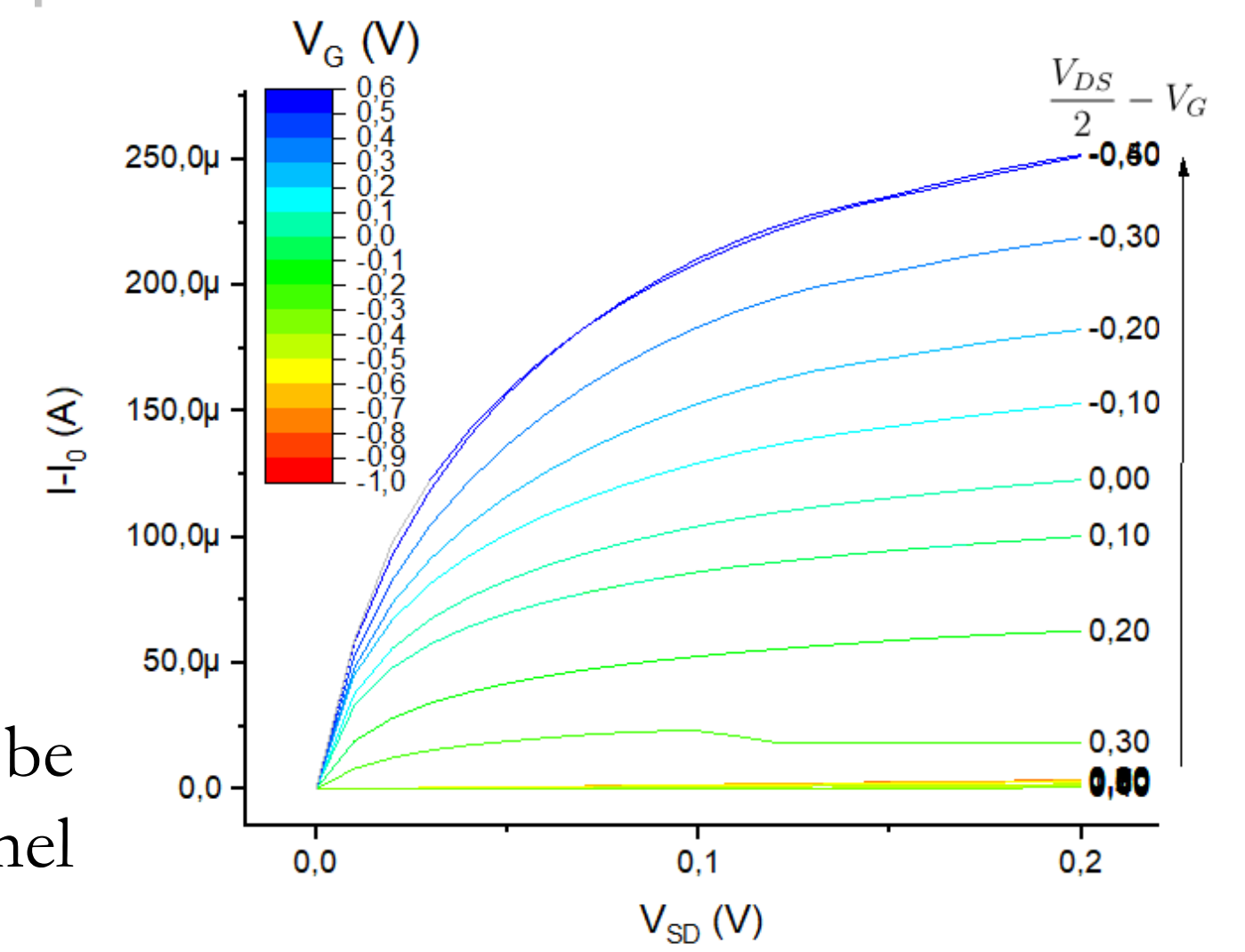
This preliminary characterization corroborates the possibility of employing this PANI-PEGDA component as valid material for biosignal monitoring, especially if considering the intrinsic flexibility, adaptability, self-supporting and tunability of its electrical properties.

Application



The PPy polymerization can be conducted to form a conductive channel between two electrodes.

This system can be characterized as an OECT and OMD by the application of an electrolyte and a third reference electrode. Preliminary results suggest an intense modulation of the current in response of an external voltage stimulus. These results suggest the use of PPy as valid material for applications on organic electronics.



Conclusions

The bio-compatibility together with the electrical and electrochemical response of both the produced 2D and 3D systems open the way to their employment in new frontiers including nanotechnologies, bioelectronics, biosensors and neuromorphic applications.

References

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