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# Cathodic studies of nanocomposites based on ($TiO_2$) and nanographite.

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## Highlights

This work investigated the voltammetric processes in the cathodic regions of electrochemical systems composed of titanium dioxide ($TiO_2$) and nanographite-based nanocomposites, aiming at their application in supercapacitors.

## Abstract

$TiO_2$ nanoparticles were prepared by the hydrothermal method, with and without the addition of ionic liquids (ILs), specifically triethylammonium tetrafluoroborate trifluoroethanesulfonic acid ([TEA-PS]·[$BF_4$]) and 1-butyl-3-methylimidazolium hydrogen sulfate ([BMIM]·[$HSO_4$]). Subsequently, $TiO_2$ powder was combined with nanographite to form nanocomposites. Thin films were prepared from working electrodes containing pure $TiO_2$ and $TiO_2$@nanographite, both with and without the presence of ionic liquids. The study investigated the electrochemical behavior of the incorporation of $TiO_2$@nanographite with the presence of ionic liquids, for application in supercapacitors. X-ray diffraction (XRD) analyses confirmed the presence of the anatase phase of $TiO_2$ and the characteristic phases of graphite. Scanning electron microscopy (SEM) revealed agglomerated $TiO_2$ nanoparticles with average sizes around 10 nm, in addition to a significant improvement. The electrochemical results showed that the incorporation of nanographite in $TiO_2$ tends to modify the electrochemical response of the metal oxide, considering that the electrochemical parameters strongly depend on the available electroactive sites, reaching specific capacitances between (15; 18.0; 19 and 20.9 F $g^{-1}$) for scan speeds of (10 to 145 mV/s) presenting an increasing behavior.

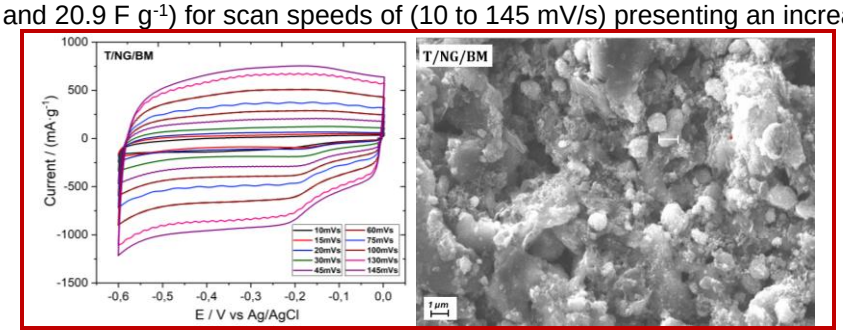


**Fig. 1.** Full voltammogram with analysis of: (T/NG/BM). Scanning electron microscopy images showed particle clusters, with sizes up to 10 nm for TiO2 synthesis and distinct characteristics, similar to samples with ionic liquid.

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