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PII: S0013-4686(18)30051-3

DOI: [10.1016/j.electacta.2018.01.033](https://doi.org/10.1016/j.electacta.2018.01.033)

Reference: EA 31015

To appear in: *Electrochimica Acta*

Received Date: 6 November 2017

Revised Date: 22 December 2017

Accepted Date: 6 January 2018

Please cite this article as: T. Schoetz, C. Ponce de Leon, A. Bund, M. Ueda, Electro-polymerisation and characterisation of PEDOT in Lewis basic, neutral and acidic EMImCl-AlCl<sub>3</sub> ionic liquid, *Electrochimica Acta* (2018), doi: 10.1016/j.electacta.2018.01.033.

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# Electro-polymerisation and characterisation of PEDOT in Lewis basic, neutral and acidic EMImCl-AlCl<sub>3</sub> ionic liquid

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## Abstract

This work studied the electro-polymerisation of 3,4-ethylenedioxythiophene (EDOT) and its electrochemical behavior in Lewis acidic, neutral and basic chloroaluminate ionic liquid 1-ethyl-3-methylimidazolium chloride aluminum chloride (EMImCl-AlCl<sub>3</sub>) by cyclic voltammetry. It was found that the electro-polymerisation on vitreous carbon only occurs in Lewis neutral EMImCl-AlCl<sub>3</sub> as a dark blue-violet film whereas the electro-polymerisation in a Lewis acidic or basic compositions is not possible due to the interactions between the conductive polymer and the ionic liquid as well as the potential stability limits of the electrolyte. PEDOT films synthesised in Lewis neutral ionic liquid were tested in monomer-free Lewis acidic, basic and neutral EMImCl-AlCl<sub>3</sub> and show different doping and de-doping behavior for chloride ionic species. The PEDOT films in a Lewis neutral composition showed higher doping levels due to the higher potential stability window, up to 2.6 V vs. Al|Al(III) than in a Lewis acidic and basic solutions. Furthermore, it was shown that the doping and de-doping levels are predefined during the electro-polymerisation of PEDOT. The anion doping and de-doping reaction reached 97% reversibility in the neutral composition, which suggests that PEDOT is a suitable electrode material to store charged species in this media and could be used in rechargeable energy storage devices.

## Keywords

Conductive polymers; electro-polymerisation; EMImCl-AlCl<sub>3</sub>; ionic liquids; PEDOT

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