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Poly(glycidyl ether)s recycling from industrial waste and reuse as electrolytes for sodium batteries / Bella, F.; Piana, G.; Ricciardi, M.; Cucciniello, R.; Proto, A.; Gerbaldi, C.. - ELETTRONICO. - (2019), pp. 174-174. (Intervento presentato al convegno Merck Young Chemists' Symposium 2019 (MYCS 2019) tenutosi a Rimini (Italy) nel November 25th-27th, 2019).

Availability:

This version is available at: 11583/2809007 since: 2020-04-06T09:56:25Z

Publisher:

Società Chimica Italiana

Published

DOI:

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Poly(glycidyl ether)s recycling from industrial waste and reuse as electrolytes for sodium batteries

Federico Bella,^{a,b} Giulia Piana,^{a,b} Maria Ricciardi,^c Raffaele Cucciniello,^c
Antonio Proto,^c and Claudio Gerbaldi^{a,b}

^a Department of Applied Science and Technology, Politecnico di Torino, Corso Duca degli
Abruzzi 24, 10129-Turin, Italy

^b INSTM Consortium, Via Giuseppe Giusti 9, 50121-Florence, Italy

^c Department of Chemistry and Biology "Adolfo Zambelli", Università degli Studi di Salerno,
Via Giovanni Paolo II 132, 84084-Fisciano, Italy
E-mail: federico.bella@polito.it

The need to recycle waste products, convert and reuse them for different high-value applications is a very up-to-date, utmost important topic. In this context, here we propose glycidol, a high-value product isolated from epichlorohydrin industry waste, as a starting material for the preparation of two poly(glycidol)s polymer matrices with a chemical structure mimicking that of poly(ethylene oxide), i.e. the most used polymer matrix for non-liquid battery electrolytes.

The materials are characterized from the physico-chemical viewpoint, showing high thermal stability. They are then obtained in the form of ionic conducting polymer electrolytes encompassing different sodium salts and solvent mixtures. Ionic conductivity values exceeding 10^{-5} S cm⁻¹ are measured in the "dry" truly solid state at 80 °C, while it approaches 6×10^{-5} S cm⁻¹ at ambient temperature in the "wet" quasi-solid state. In addition, poly(glycidol)-based polymer matrices show reasonably wide electrochemical stability towards anodic oxidation.

It envisages their possible use as separating electrolytes in secondary batteries, which is also demonstrated by preliminary charge/discharge cycling tests in lab-scale sodium cells [1]. The present findings pave the way to a circular economy platform starting from industry wastes and ending with post-lithium storage systems.

[1] G. Piana, M. Ricciardi, F. Bella, R. Cucciniello, A. Proto, and C. Gerbaldi, *Chem. Eng. J.*, DOI: 10.1016/j.cej.2019.122934.