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

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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.