Deep Eutectic Solvents as a potential solution for the new generation of energy storage systems: from electrochemical to thermoelectric devices

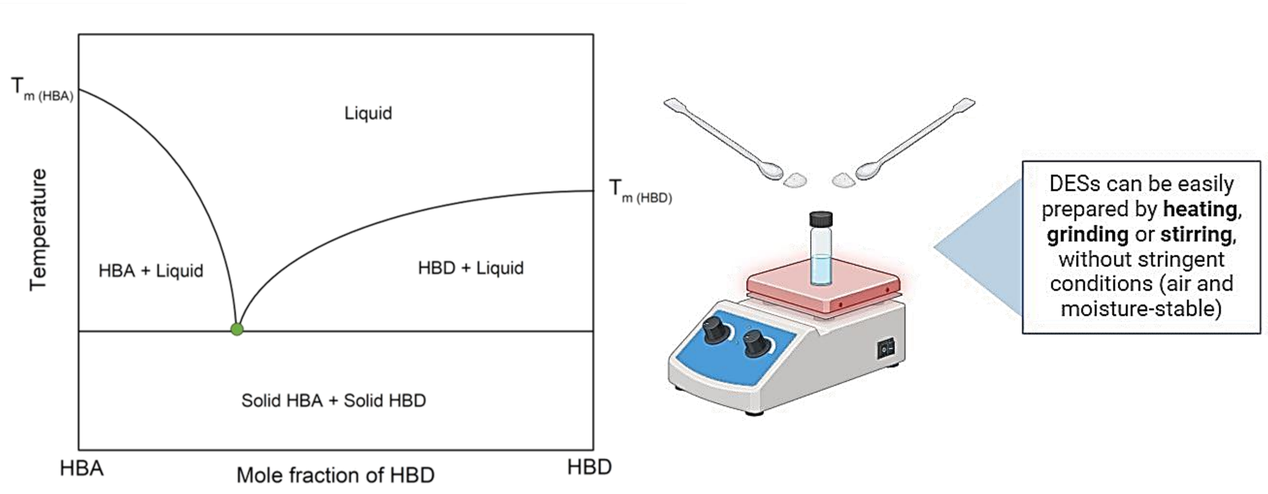
D. Motta[1], S. Nejrotti[1], G.A. Elia[2,3], A. Damin[1], S. Galliano[1], A. Reale[4], C. Gerbaldi[2,3], C. Barolo[1,2] and M. Bonomo[1,2]

[1] Department of Chemistry and NIS Interdepartmental Centre, University of Turin, Via Pietro Giuria 7, Torino, 10125, Italy
[2] National Reference Center for Electrochemical Energy Storage (GISEL) - INSTM, Firenze 50121, Italy
[3] GAME Lab, Department of Applied Science and Technology (DISAT), Politecnico di Torino, Torino 10129, Italy
[4] C.H.O.S.E. (Centre for Hybrid and Organic Solar Energy), Department of Electronic Engineering, University of Rome-Tor Vergata, via del Politecnico 1, 00133 Rome, Italy

daniele.motta@unito.it

Introduction

The last few years have shown how much the price of non-renewable resources is influenced by global events and the catastrophic consequences related to the exploitation of these very resources [1]. Electrochemical energy storage systems (EESS), such as batteries and supercapacitors, and thermo-electrochemical cells (TECs) play a crucial role in the energy transition, since they encourage the harnessing of renewable energy (solar, wind and waste thermal power). In this contribution, we present an overview on Deep Eutectic Solvents (DESs) as alternative electrolytes, capable of providing in-device performance comparable to that of traditional ones, which are made up of thermally unstable electrolytes and/or critical raw materials [2-3].

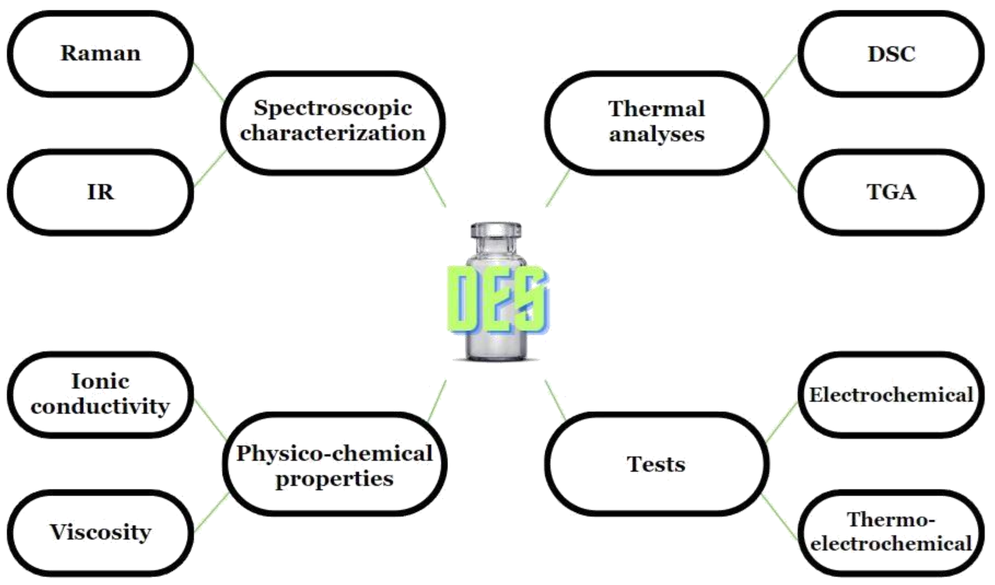


Why Deep Eutectic Solvents?

DESs are an emerging class of low-cost solvents, that are based generally on a halide salt, which acts as a hydrogen bond acceptor (HBA), and an alcohol/organic acid, which acts as a hydrogen bond donor (HBD) [4]. They demonstrate high thermal stability, low vapor pressure, good biodegradability and good inertness to humidity, features that make these systems attractive for application in EESS and TECs. However, the development of DESs in this field is only at the beginning, even though some publications [5-6], and some of our preliminary study, demonstrates how they have huge potential as sustainable electrolytes.

Are DESs really sustainable?

In literature, there is the consolidated idea that DESs are sustainable, biodegradable and harmless. Although in many cases this is true, some mixtures show surprisingly the contrary [7-8]; indeed, not only in some cases natural compounds may not be biodegradable under certain conditions, but there are DESs which exhibit lower biodegradability or higher toxicity than the separate compounds because of synergistic effects. Moreover, many of the natural compounds suitable for creating DESs are not easily accessible in large quantities or cost-competitive compared to existing solvents.



Roadmap

To progress within the DESs field, each proposed mixture must be accompanied by all the information necessary to completely define that mixture. After all, sustainability, biodegradability and toxicity of the formulated DESs must be investigated to provide a comprehensive overview.

References

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