

NEW ELECTROLYTES BASED ON IONIC LIQUIDS FOR APPLICATION IN ELECTROCHEMICAL SOLAR CELLS AND BATTERIES

DESCRIPTION OF THE INVENTION

The invention developed by researchers at the Universitat Jaume I in Castelló and at CIDETEC in San Sebastián consists in a set of new electrolytes based on ionic liquids that contain the sulphide/polysulphide redox couple. Obvious applications include their use in electrochemical and optoelectronic devices and, more specifically, in dye-sensitised solar cells with semiconductors and in batteries. These electrolytes do not contain water or any additional solvents and can enhance the performance, stability and durability of the electrochemical and optoelectronic devices in which they are applied.

Electrolytes are a crucial part of electrochemical devices. In the particular case of solar cells that have been sensitised with inorganic semiconductor materials, the biggest problem is to find a non-volatile electrolyte that combines an electrochemically stable redox couple, that is not corrosive and that is also transparent and compatible with photosensitising material.

I⁻/I₃⁻ (Iodide) is the redox couple that has received most attention from researchers and which yields the best performance in the case of dye solar cells.

This redox couple, however, is not compatible with inorganic materials owing to the rapid degradation it causes in them.

The new electrolytes protected by this patent, based on ionic liquids that contain the sulphide/polysulphide couple, overcome this drawback and thus become the best candidates for use in the manufacture of a new generation of solar cells to replace silicon-based technology in applications where this latter is not so versatile, such as in indoor applications.

Likewise, this technology may also have a potentially bright future applied to the field of the production of batteries with a higher energy density. Batteries based on a lithium-sulphur (Li-S) combination are a highly promising alternative to today's lithium-ion batteries for improving the performance of devices in which they are installed, such as electric vehicles. Their main advantage is that they can offer three times the autonomy of the lithium batteries currently in use, but without increasing the size and the weight, and at a lower cost.

SECTORS FOR COMMERCIAL APPLICATION

Sectors in which this invention could be applied would be those in the field of materials technology and chemistry:

- Electrochemical solar cells.
- Lithium-sulphur batteries.
- Electrochromic devices.
- Electrochemical biosensors.
- Electrodeposition of materials for coatings.

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TECHNICAL ADVANTAGES AND COMMERCIAL BENEFITS

The main advantage of the new ionic liquid-based electrolytes containing the sulphide/polysulphide redox couple is that they prolong the lifespan of the solar cells and the batteries in which they are used due to the fact that:

They do not degrade the inorganic semiconductor materials used inside the electrochemical devices. Their low level of volatility ensures longer life.

Savings are achieved in the cost of sealing electrochemical devices.

Batteries could be developed using sulphur, one of the most abundant (and therefore most economical) materials on Earth.

STAGE OF DEVELOPMENT OF THE TECHNOLOGY

The electrolytes are fully developed. With regard to the cells, the electrolytes have been tested in quantum dot cells, yielding excellent results in terms of device stability compared with existing technology.

With regard to the application of these electrolytes in batteries, the patent holders are presently carrying out a concept-testing project aimed at validating the properties of the patented compounds in a direct industrial application.

INDUSTRIAL PROPERTY RIGHTS

This invention is protected by the European patent with reference number EP11723398.1, date of application 19/05/11 and priority date 20/05/10.

COLLABORATION SOUGHT

Please state the type of collaboration sought:

Licence agreement for use, manufacture or commercialisation.

R&D project to finish development or apply the electrolytes to other sectors.

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