

Molecular machines can be used for energy storage systems

What are molecular solar thermal energy storage systems (MOST)?

We define their common properties as an innovative molecular system that can store solar energy into chemical bond strain and later release it on demand. Such photoisomers are referred to as molecular solar thermal energy storage systems (MOST), also known as solar thermal fuels (STF).

How does artificial molecular machinery work?

Inspired by such systems, autonomous artificial molecular machinery is being developed that functions by catalysing the decomposition of chemical fuels, exploiting kinetic asymmetry to harness energy released from the fuel-to-waste reaction to drive non-equilibrium structures and dynamics.

What is a molecular machine?

A molecular machine can be defined as an assembly of a discrete number of molecular components that exhibit controlled mechanical movements in response to an external stimulus. Molecular switches and motors are classes of molecular machines, which, as pointed out in the Introduction, belong to the broader category of molecular devices.

Can chemists make molecular machines?

In the past few decades, chemists have learned to make molecular machines, that is, synthetic chemical systems in which energy inputs cause controlled movements of molecular components that could be used to perform a task.

How do molecular pumps work?

In fact, molecular pumps are energy transducers capable of converting the energy input of the device into a chemical potential; in other words, they can use an external energy source to generate a nonequilibrium state.

Why are energy storage devices important?

Energy storage devices play an essential part in efficiently utilizing renewable energy sources and advancing electrified transportation systems. The rapid growth of these sectors has necessitated the construction of high-performance energy storage technologies capable of storing and delivering energy reliably and cost-effectively.

Molecular solar thermal energy storage systems (MOST) offer emission-free energy storage where solar power is stored via valence isomerization in molecular photoswitches. These ...

At the molecular level, energy conversion and storage with molecular machines requires a precise coupling of mechanical and chemical processes and the ability to generate nonequilibrium states that can persist over time as long as energy ...

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Several methods for storing solar energy, such as the use of electrochemical batteries, hydrogen energy storage, and carbon dioxide conversion, are being implemented. 5 ...

Therefore, the development of novel catalysts is important for their potential contributions in energy saving and environment protection. Molecular machines can respond to external stimuli and realize dynamic ...

The design of synthetic systems that mimic the ability of biological systems to control chemical reactions using intricate molecular machines is a long-held dream of nanotechnology. This Review ...

One approach is the development of energy storage systems based on molecular photoswitches, so-called molecular solar thermal energy storage (MOST). By using organic photoswitchable ...

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