Calcium carbide as energy storage

What is calcium-based thermochemical energy storage (TCES)?
Calcium-based thermochemical energy storage (TCES) provides a realizable solution to address the challenges of intermittence and volatility in the large-scale utilization of clean energy. Although modified CaCO3/CaO systems have shown promise for stable cyclic performances, the modification mechanism of diff

Can Cao-based absorbents be used as a thermochemical energy storage method?
Calcium looping of CaO-based absorbents is one of the most promising methods of thermochemical energy storage. However,the sintering of pores and a reduction in the CO 2 diffusion rates as the carbonization/calcination cyclic reaction progresses have posed challenges to the practical application of CaO-based absorbents.

What is the role of carbide slag absorbents in a Cao/CaCO 3 system?
Good carbonation performance and cyclic stability of the carbide slag absorbents are essential for achieving efficient thermochemical energy storageof the CaO/CaCO 3 system. Cycle experiments include carbonization and calcination cycles.

Does carbide slag improve cyclic stability of Cao-based absorbents?
The present work focuses mainly on improving the stability of CaO-based absorbents using carbide slag subjected to cyclic reactions. MgO and ZnO doping of the slag was proposed. This doping allowed reasonable use of solid waste carbide slag and improved the cyclic stabilityof the CaO/CaCO 3 system and energy storage performance.

What are the optimal reaction conditions for carbide slag absorbent calcium cycle?
In this study,the optimal reaction conditions for the carbide slag absorbent calcium cycle are as follows: The calcination reaction occurs at 850 °Cwith a pure N 2 atmosphere and a reaction time of 20 min. The carbonization reaction occurs at 650 °C with a pure CO 2 atmosphere and a reaction time of 40 min.

What is the structure of carbide slag absorbents after 10 cycles?
After 10 cycles,the carbide slag absorbents are characterized mainly by an amorphous structure,with many small particles attached to the surface of each absorbent. The structure of the CS absorbent undergoes considerable sintering where the particle size increases and the surface area decreases.

In this regard, a novel energy storage system combined with a calcium carbide production process, a steam Rankine cycle, an organic Rankine cycle, and a hot water unit is ...

In this paper, the ability of thermochemical energy storage materials to release and store thermal energy during cyclic carbonization/calcination reactions is described by the amount of CO 2 absorbed by CaO in the carbide slag absorbent.

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Solar energy serves not only as the heat source for hydrogen production but also drives the CaL process, enabling carbon enrichment and energy storage within the calcium-based materials. When calcium-based materials are introduced into the reactor, they release energy and capture CO 2, with coordinated energy and mass transfer promoting reactions that produce high ...

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Thermochemical energy storage based on CaO/CaCO 3 cycles is a promising technique used in concentrated solar power plant. The high global efficiency can be achieved under high carbonation pressure and temperature. In this work, limestone and carbide slag were chosen as the representatives of Ca-based natural and waste materials, respectively.

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Therefore, in this paper, calcium-based materials with both high optical absorption and high energy release density were synthesized to directly convert solar energy to chemical energy for storage. Doping metal elements ...

Herein, a new type of calcium-based absorbent was prepared via a wet process using calcium carbide slag as the calcium source and MnO 2 as the dopant. The results showed that when the concentration of ethanol was ...

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Facing the application in future industrial scenarios with high levels of renewable energy penetration, this study couples the liquid air energy storage to oxygen-thermal calcium carbide manufacturing industry by sharing an air separation unit. It is a chemical material and electricity co-production concept to reduce the specific ...

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solar power plant. The high global efficiency can be achieved under high carbonation...

The use of formic acid as a solvent to acidify modified calcium carbide slag for the preparation of energy-storage materials improves the internal structure of the energy-storage materials, which facilitates the entrance of carbon dioxide into the energy-storage material during the diffusion reaction stage to initiate carbonation ...

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Therefore, in this paper, calcium-based materials with both high optical absorption and high energy release density were synthesized to directly convert solar energy to chemical energy for storage. Doping metal elements into a Ca-based material was demonstrated to play a positive role in improving cycling stability on the energy release process.

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