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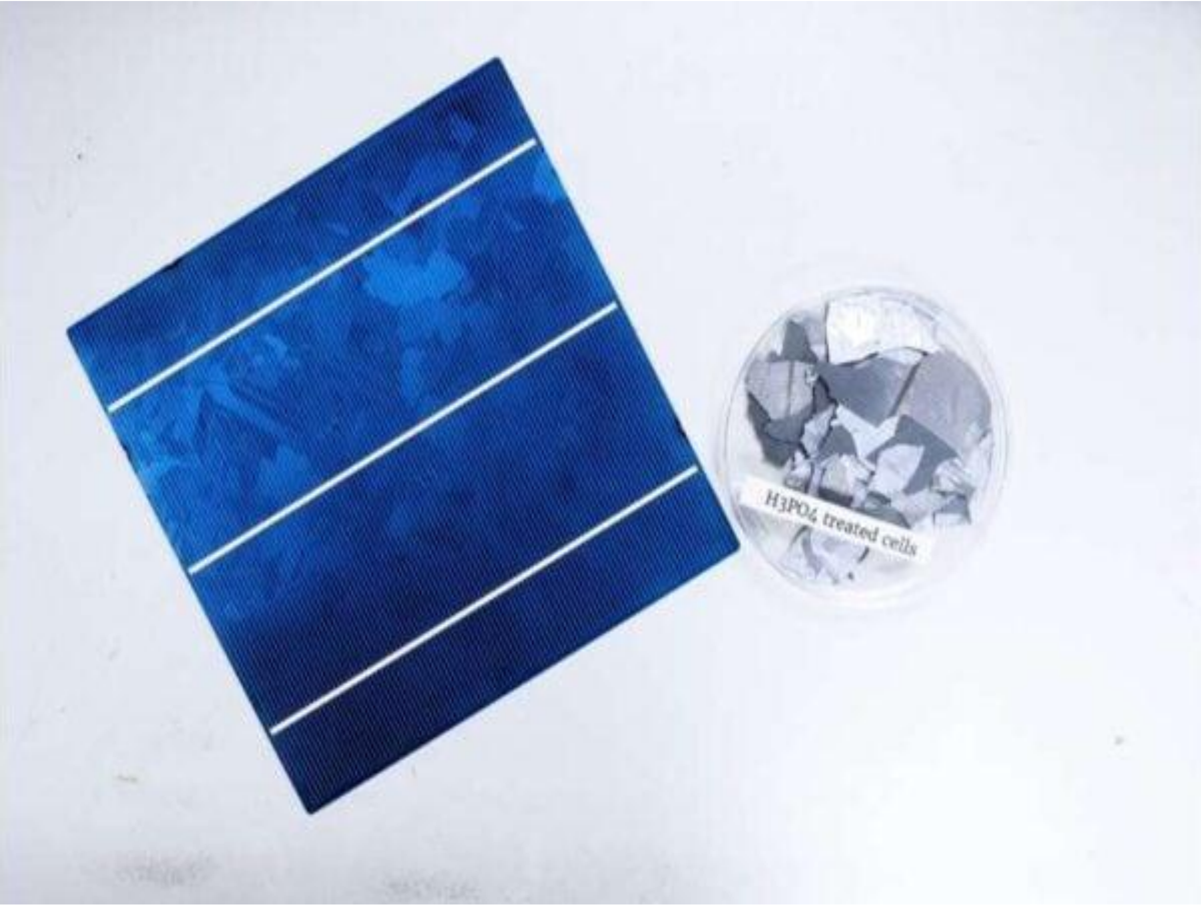

Recycling solar panels for EV batteries

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By Nick Flaherty

MATERIALS & PROCESSES

Researchers in Singapore have developed an efficient method of recovering high-purity silicon from expired solar panels to produce lithium-ion batteries.

The team at Nanyang Technological University (NTU) used phosphoric acid, a substance commonly used in the food and drink industry, as a single reagent rather than using several different chemicals for recycling solar panels. This also has a higher recovery rate and purity than today's silicon recovery technologies.

High-purity silicon makes up the majority of solar cells, yet they are typically discarded at the end of their operational lifespan after 25 to 30 years. It is challenging to separate the silicon from other solar cell components such as aluminum, copper, silver, lead, and plastic. Moreover, recycled silicon has impurities and defects, making it unsuitable for other silicon-based technologies.

Existing methods to recover high-purity silicon are energy-intensive and involve highly toxic chemicals, making them expensive and limiting their widespread adoption among recyclers.

"Our approach to silicon recovery is both efficient and effective. We do not have to use multiple chemicals, reducing the time spent on post-treatment of the chemical wastes. At the same time, we achieved a high recovery rate of pure silicon comparable to those produced by energy-intensive extraction techniques," said Nripan Mathews, Associate Professor Nripan Mathews, Provost's Chair in Materials Science and Engineering and Cluster Director of the Energy Research Institute at NTU (ERI@N).

The 30 year lifespan of solar panels means that 78 million tons of solar panels are due to expire by 2050. The NTU research team believes their silicon recovery method can potentially solve the growing problem of solar panel waste by keeping resources in a loop.

- Standard needed for solar panel recycling
- French deal for recycling solar panels
- Enel shows progress on Europe's largest solar panel plant

The NTU approach involves first soaking the expired solar cell in hot diluted phosphoric acid for 30 minutes to remove metals (aluminium and silver) from their surfaces. This process is repeated using fresh phosphoric acid to ensure complete removal of the metals, resulting in pure silicon wafer at the end of another 30 minutes.

The NTU Singapore researchers used the silicon from the recycled solar panels in a lithium-ion battery anode and tested it for efficiency. Results showed that it performed similarly to new, commercially bought silicon. Spectroscopic analyses showed the sample achieved a recovery rate of 98.9 percent with a purity of 99.2 percent, comparable to silicon recovered through currently available methods.

When the recovered silicon was upcycled into a lithium-ion battery anode and tested for efficiency, it performed similarly to new, commercially bought silicon.

“The comparable performance between our upcycled silicon-based lithium-ion battery and the newly purchased ones proves that the NTU approach is feasible. We envision our faster and cheaper silicon recovery method to be a positive boost for the development of EV batteries. Aside from EVs, there are also potential applications such as thermoelectric devices,” said Dr. Sim Ying, Research Fellow, Energy Research Institute at NTU.

www.ntu.sg