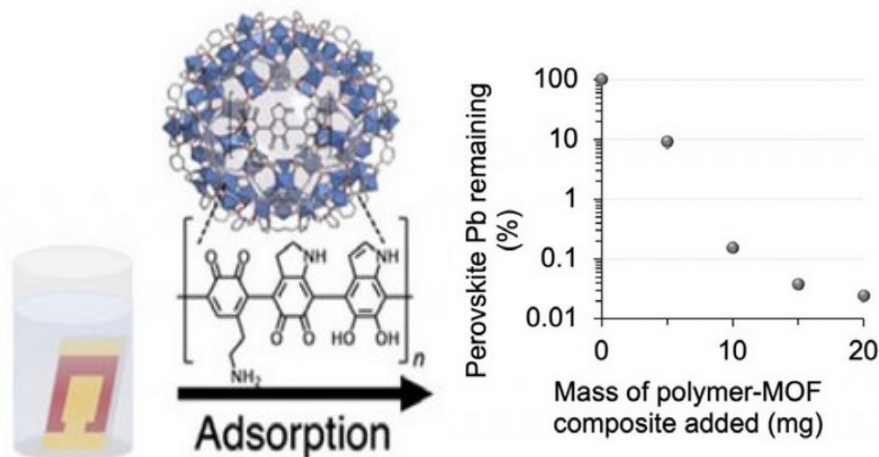


Adsorbent Material for Sequestrating Toxic Materials in Perovskite Solar Cells



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Key words

Lead Sequestration, Metal-organic framework, perovskite solar cells (PSC), polymer composite and safe by design PSCs

Intellectual Property

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Description

While perovskite solar cells (PSCs) have achieved an exceptional power conversion efficiency of >25% in the last ten years, the lead-based material responsible for light absorption in the PSC devices is toxic. Unfortunately, if a PSC ruptures, the light-absorbing material is readily dissolved in water, posing the risk of lead being leached into the surrounding environment. Thus, such lead-based PSCs pose potential environmental concerns in the event of device failure. Moreover, waste regulations in various places, like the EU and China, would hold solar cell producers responsible for any downstream environmental or health effects. Such conditions require a safe by design (Sbd) approach for lead-based perovskite solar cells, which is the topic of this patent. The method presented here is to equip PSCs with a metal-organic framework (MOF) polymer composite, a highly selective and efficient lead adsorbent. MOFs (metal-organic frameworks) are highly porous sponge-like structures with extraordinary internal surface areas, allowing the adsorption of large quantities of guest species. We have shown that when equipped with a selected polymer, the material can rapidly and selectively extract the lead from various

aqueous streams, such as rainwater at varying pH, quickly bringing the liquids to levels deemed drinkable. Thus, this patent presents an effective strategy to sequester lead, either from liquids that result from PSC production or from rainwater that is exposed to cracked PSCs in the field.

Advantages

- Functions over a broad pH range and in aqueous solutions having various compositions.
- Rapidly extracts large quantities of lead.
- Can reduce lead concentrations to those deemed acceptable.

Applications

- Remediation of lead used during PSC production.
- Adsorbents can capture the lead before it is leached into the ground safeguarding solar cell devices in the field.