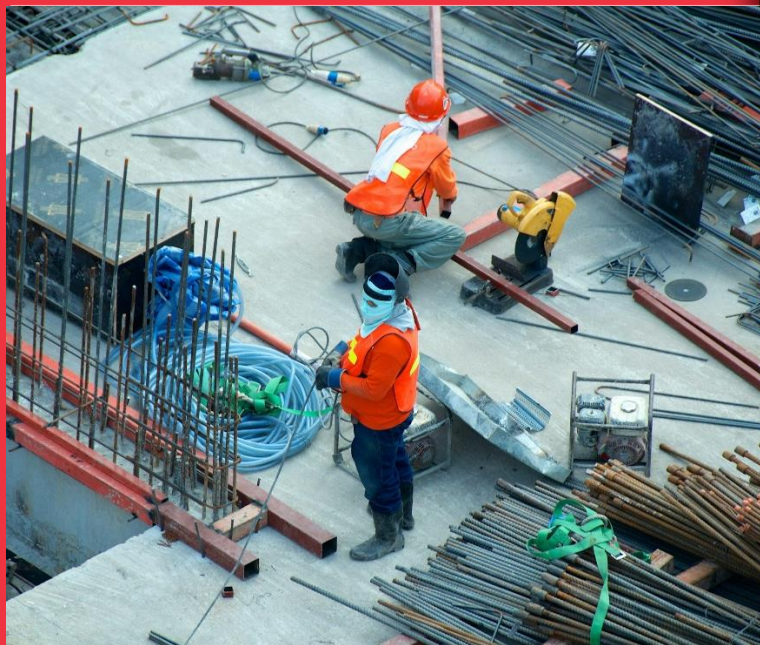




Sustainable Construction Material Using Spent Graphite

SP Singapore Polytechnic

Technology Licensing Opportunity

Technology Overview

The global surge in battery usage from electric vehicles and portable electronics has created a critical environmental crisis as spent graphite from battery recycling ends up in landfills, contributing to pollution and massive resource wastage. Current battery recycling processes fail to address graphite recovery, leaving this valuable carbon material to accumulate as environmental waste despite its potential for reuse. The construction industry simultaneously faces pressure to adopt sustainable materials, yet lacks viable solutions for incorporating recycled battery components, creating a missed opportunity to address both waste management and sustainable construction challenges simultaneously.

Our research transforms this environmental liability into a valuable construction resource by developing purification methods that convert spent battery graphite into sustainable construction materials. The technology employs economically viable purification processes to remove heavy metal contaminants, making spent graphite suitable as a supplementary material in cement mortar at various concentrations whilst meeting SS-EN-197 Singapore Standards. Comprehensive leaching tests following NEA requirements and US-EPA-1311 regulations confirm environmental safety across all maturation stages. Additionally, the spent graphite can be converted into expandable graphite for flame-retardant applications, providing enhanced thermal properties including reduced thermal conductivity and improved thermal comfort. This innovation transforms battery waste from an environmental burden into high-performance construction materials, creating a circular economy solution that addresses both waste management and sustainable building needs.

Potential Applications

- Cement Industry as cementitious material replacement to reduce carbon footprint
- Mortar / Plaster Pre-blending industry to produce the product
- Concrete Industry as a cement replacement
- Precast construction industry

Commercialization / R&D Opportunities

- ✓ Ready for commercialization
- ✓ Looking collaborators for further development / to develop new applications
- ✓ Available for licensing
- ✓ Accepting business plans from interested parties

Intellectual Property -

- Know-how

Technology Features & Specifications

- Promotes circular economy by upscaling spent graphite as sustainable building material
- Reduction in embodied carbon footprint of construction materials by partial replacement of cement with spent graphite
- Reducing cost of the mix composition with reduction in cement
- Saving in global warming potential associated with construction material like plaster and mortar
- Identified most economically viable purification method to remove heavy metal contaminant from spent graphite
- Reduce the dependency on the import of construction materials into Singapore
- Enhance the value of spent graphite by converting it into EG with the excellent flame-retardant properties of EG

Unique Value Proposition

- With reference to the report published by McKinsey & Company, the global demand for Li-ion batteries (LIB) is expected to be increased from 700 GWh in 2022 to 4.7 TWh by 2030. According to new research by Next Move Strategy Consulting, the Singapore Battery Market was valued at US\$ 365.3 million in 2022 and is predicted to be reached US\$ 1336.1 million by 2030, with a CAGR of 17.6% from 2023 to 2030. The escalating utilization of batteries brings forth the challenge of managing used batteries and necessitates a constant need to recycle materials, to mitigate the adverse environmental impact of their disposal in landfills
- Cement, despite being the most widely utilized construction material, emerges as a notable concern due to its substantial contribution to carbon dioxide emissions. Approximately 8% of global carbon dioxide emissions can be attributed to the production of cement. This considerable environmental impact arises primarily from the energy-intensive processes involved in cement manufacturing process.
- In the pursuit of a sustainable future, it is crucial to explore innovative strategies for diminishing the use of materials associated with high embodied carbon emissions. This necessitates the identification and adoption of alternative materials, fostering a transition towards a circular economy model. By prioritizing materials with lower environmental impact, we can contribute to a more sustainable and ecologically responsible approach to resource utilization. Embracing such practices aligns with the broader global commitment to reduce carbon footprints and advance environmental management.
- The recovered graphite often find application in secondary industries such as production of lubricants, conductive material etc. and rest sent to landfill.

Disclaimer

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