CO_2 based self catalyzed dynamic bond for epoxy covalent adaptable network

KEYWORDS

Recyclable Epoxy Resin
Dynamic Bonding Network
Self-Catalyzed System
CO_2-Based linkages

PATENT

Title: Covalent adaptative network

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LICENSING

Exclusive, non-exclusive licences and research collaborations

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PROBLEM

Epoxides, widely used in adhesives, coatings, and composite matrices for industries like electronics, construction, and aeronautics, present significant end-of-life challenges. Once cured, these materials are non-reusable, non-recyclable, and typically end up in landfills or incinerators.

This also limits composite manufacturing processes, as uncured epoxy composites need cold storage to prevent premature reactions. While covalent adaptive networks (CANs) offer reprocessability by incorporating dynamic bonds, they often require toxic, expensive catalysts, are challenging to scale, and rarely use renewable sources, limiting their applicability.

SOLUTION

This invention introduces a new class of dynamic system that enables the recycling, reshaping, and re-use of epoxy-based resins.

Utilizing a CO_2-based linkage with the epoxy network, this system provides an internally catalyzed structure that reprocesses efficiently without external catalysts. The cyclic carbonates, derived from CO_2 and epoxy molecules, are safe, potentially bio-based, and scalable, requiring minimal modification to existing epoxy systems.

This approach yields recyclable composites that maintain processing stability and improve fire resistance. Additionally, the polymer can be degraded under mild conditions, allowing fiber recovery for reuse in applications like transportation, electronics, and sports equipment, where demand for recyclable thermosets is rising.

INNOVATION

- Low-toxicity, cost-effective monomer suitable for large-scale applications
- Self-catalyzed dynamic epoxy network
- Use of CO_2-derived cyclic carbonates
- Compatibility with existing epoxy-amine systems
- Catalyst-free transcarbamoylation technology

TECHNOLOGY STATUS

TRL 3-4

MARKETS

- **Automotive & Aeronotics**
- **Naval**
- **Electronics**
- **Sports & Leisure**
- **Construction**
- **Energy**

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