

The Global Self-Healing Materials Market 2025-2035

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Abstracts

Self-healing materials represent a revolutionary class of smart materials engineered to detect damage and autonomously repair themselves, mimicking biological systems' remarkable ability to heal wounds. These materials incorporate specialized mechanisms that activate upon damage, initiating repair processes without external intervention to restore structural integrity and functional properties. This autonomous repair capability addresses a fundamental limitation of conventional materials – their inevitable degradation through mechanical damage, environmental exposure, and aging.

By extending product lifespans and reducing maintenance requirements, these materials offer substantial economic benefits through decreased replacement frequency, minimized downtime, and reduced repair costs. In critical applications like aerospace components, infrastructure elements, and medical implants, self-healing capabilities enhance safety by preventing catastrophic failures that could result from undetected damage progression. Self-healing technologies operate through several distinct mechanisms. Extrinsic systems utilize embedded healing agents in microcapsules or vascular networks that release upon damage to fill cracks and restore properties. Intrinsic systems leverage dynamic chemical bonds that can reform after breakage, enabling multiple healing cycles without depleting resources. Advanced approaches include shape memory assisted healing and stimulus-responsive systems activated by heat, light, or electrical signals.

The environmental impact of self-healing materials is particularly significant, as they contribute to sustainability by reducing material consumption, extending product lifespans, and decreasing waste generation. By enabling longer service life for everything from concrete infrastructure to electronic components, these materials align with circular economy principles and resource conservation objectives.

As manufacturing processes mature and costs decrease, self-healing capabilities are

transitioning from specialized high-value applications toward mainstream adoption across consumer products, building materials, transportation systems, and electronic devices. This evolution is accelerating through interdisciplinary collaboration between materials scientists, chemists, engineers, and biologists, who continue to develop increasingly sophisticated self-healing mechanisms inspired by natural processes and enhanced through advanced manufacturing techniques.

The automotive and aerospace sectors currently lead adoption. Self-healing clearcoats and protective finishes in automotive applications have transitioned from luxury vehicles to mainstream production models, while aerospace implementations focus on structural components and corrosion-resistant coatings that enhance safety while reducing maintenance intervals. Construction materials represent the fastest-growing application segment, with self-healing concrete solutions gaining regulatory approval across major markets and demonstrating promising performance in infrastructure applications.

Looking forward, several significant trends will shape market evolution through 2035. Regulatory frameworks increasingly recognize self-healing materials as enabling sustainability by extending product lifecycles and reducing replacement frequencies. Environmental considerations are driving development of bio-based self-healing systems, with early commercial products demonstrating promising performance while reducing carbon footprints. Integration with sensor technologies and digital monitoring systems represents a transformative trend, creating 'smart' self-healing materials that communicate damage status and healing progress.

Technical challenges remain in scaling production while maintaining performance consistency, but continuous improvements in manufacturing processes are steadily addressing these limitations. Cost premiums over conventional materials remain a barrier in price-sensitive applications, though lifecycle cost analyses increasingly demonstrate favorable economics when maintenance and replacement expenses are considered. As the technology matures, self-healing capabilities will increasingly be viewed as standard requirements rather than premium features across multiple industries, driving broader adoption beyond current high-value applications into consumer products, electronic devices, and general industrial use. This transition from specialty to mainstream material solution will define the market's evolution over the coming decade.

The Global Self-Healing Materials Market 2025-2035 provides insights into the rapidly evolving self-healing materials landscape, tracking growth trajectories, technological developments, and commercialization strategies through 2035.

Key Report Contents include:

Market Analysis and Growth Projections

Market Size and Forecast: Detailed revenue projections from 2025-2035, with historical context from 2015

Segmentation by Material Type: Comprehensive breakdown across self-healing polymers, coatings, concrete, metals, ceramics, and composite materials

Segmentation by Healing Mechanism: Comparative analysis of microencapsulation, vascular systems, intrinsic self-healing, and shape memory technologies

Regional Market Distribution: Granular geographic assessment with regional adoption rates, growth drivers, and market development patterns

Technology/Application Matrix: Visual mapping of optimal technology solutions for specific industry challenges

Technology Analysis

Extrinsic Self-Healing Mechanisms: Comprehensive analysis of microencapsulated healing agents, vascular networks, reversible bonds, and external stimulation approaches

Intrinsic Self-Healing Systems: Detailed examination of reversible covalent bonds, ionomers, polymer networks, microscopic mobility, and supramolecular chemistry

Material-Specific Technologies: Specialized analysis of self-healing polymers, elastomers, hydrogels, concrete, ceramics, metals, and nanomaterial systems

Biomimetic Approaches: Assessment of nature-inspired self-healing mechanisms with commercialization potential

SWOT Analysis: Strategic evaluation of strengths, weaknesses, opportunities, and threats for major self-healing technology categories

Application Analysis by End-Use Market

Aerospace: Self-healing composites, thermal interface materials, and protective coatings

Automotive: Scratch-resistant finishes, self-healing glass, composites, and tire technologies

Electronics: Display technologies, flexible electronics, wearables, soft robotics, and sensor applications

Energy Storage: Battery components, solid electrolytes, fuel cell membranes, and solar technologies

Construction: Self-healing concrete, asphalt, protective coatings, and structural materials

Healthcare: Tissue engineering scaffolds, drug delivery systems, artificial skin, dental composites, and orthopaedic applications

Additional Sectors: Detailed coverage of paints/coatings, adhesives/elastomers, filtration membranes, textiles, military/defense, oil/gas, and marine applications

Commercialization Status and Strategic Insights

Technology Readiness Assessment: TRL evaluation framework applied to major self-healing technologies

Commercial Product Analysis: Comprehensive profiles of marketed products with performance metrics and market positioning

Intellectual Property Landscape: Patent analysis revealing innovation trends, strategic positioning, and IP concentration

Market Entry Barriers: Identification of technical, economic, and regulatory challenges with mitigation strategies

Technology Roadmap: Visual strategic pathway for self-healing material development through 2035

Competitive Landscape

Company Profiles: Detailed assessments of 35+ key players including technology portfolios, commercialization status, and strategic direction. Companies profiled include 3M, A2O Advanced Materials Inc., ABB, Acciona S.A., Advanced Soft Materials, Inc., Aizawa Concrete Corporation, Akzo Nobel N.V., Applied Thin Film, Inc., Arkema S.A., Basilisk, Battelle, CompPair Technologies Ltd., Covestro AG, Croda, DMAT, DS Smith, Dupont Teijin Films, Epion, Evonik Industries AG, Feynlab, Helicoid Industries, Henkel, Hyundai Motor Group, JP Concrete, Kansai Paint Company, Mimicrete, NATOCO Co., Ltd., and more, covering established multinational corporations, specialized material developers, and innovative startups across the value chain.

Future Outlook and Strategic Opportunities

Market Acceleration Factors: Identification of technical breakthroughs, policy developments, and market drivers that could accelerate adoption

Cross-Industry Convergence: Emerging opportunities at the intersection of self-healing materials with IoT, smart manufacturing, and circular economy initiatives

Sustainability Implications: Analysis of environmental benefits, lifecycle advantages, and alignment with ESG objectives

Contents

1 EXECUTIVE SUMMARY

- 1.1 Market opportunity for self-healing materials
- 1.1 Benefits of self-healing
- 1.2 Types of healing by material formulation and format
- 1.3 Technology roadmap by application
- 1.4 Trends in self-healing materials
- 1.5 Commercialising self-healing products
 - 1.5.1 Construction materials
 - 1.5.2 Protective paints and coatings
 - 1.5.3 PVC cutting mats
- 1.6 Biomimetics
 - 1.6.1 Key biological repair strategies
- 1.7 Global market revenues, historical and forecast to 2035
 - 1.7.1 Total
 - 1.7.2 By type
 - 1.7.3 By end use market
 - 1.7.4 By region
- 1.8 SWOT analysis
- 1.9 Comparison of Self-Healing Materials with Incumbent Materials by Market Sector

2 INTRODUCTION

- 2.1 Self-healing mechanism and categorization
 - 2.1.1 Introduction
 - 2.1.2 Viscous creep
 - 2.1.3 Intrinsic and Extrinsic Mechanisms
 - 2.1.4 Atomic Toolkit
 - 2.1.5 Metrics for self-healing
- 2.2 Extrinsic self-healing
 - 2.2.1 Microencapsulated healing agents
 - 2.2.1.1 Implementation of microcapsule-based self-healing systems
 - 2.2.1.2 Manufacturing of microcapsules
 - 2.2.1.3 Convergence of self-healing materials and pharmaceutical delivery
 - 2.2.2 Vascular self-healing
 - 2.2.3 External Stimulation
 - 2.2.4 SWOT analysis

2.3 Intrinsic self-healing

- 2.3.1 Supramolecular Bonding
- 2.3.2 Reversible Covalent Bonds
- 2.3.3 Ionomer Healing
- 2.3.4 Microscopic Mobility
- 2.3.5 Microcapsule Monomer Diffusion
- 2.3.6 Sustainable intrinsic self-healing materials
- 2.3.7 SWOT analysis
- 2.3.8 Comparison of self-healing systems.

2.4 Healing volume

2.5 Shape memory assisted self-healing

- 2.5.1 Overview
- 2.5.2 Principle of Shape Memory Assisted Self-Healing (SMASH)
- 2.5.3 Shape Memory with Polymers
- 2.5.4 Materials
- 2.5.5 Self-healing coatings
- 2.5.6 Anti-corrosion
 - 2.5.6.1 Types
- 2.5.7 Scratch repair
 - 2.5.7.1 Mechanisms underlying scratch repair

2.6 Self-healing polymers

- 2.6.1 Self-Healing Polymer Toolkit
- 2.6.2 Intrinsic Self-Healing
 - 2.6.2.1 Covalent-Based Intrinsic Self-Healing
- 2.6.3 Self-Healing Polypeptides
- 2.6.4 Reversible Crosslinkers
- 2.6.5 Rapid Polymerization
- 2.6.6 Polyvinyl chloride (PVC) based self-healing
- 2.6.7 Self-Healing Elastomers
- 2.6.8 Self-Healing Fiber-Reinforced Polymers (FRPs)
 - 2.6.8.1 Self-healing strategies for FRPs
 - 2.6.8.2 Applications
 - 2.6.8.3 Challenges
 - 2.6.8.4 Hollow fiber embedment
- 2.6.9 Self-healing metals
- 2.6.10 Metal matrix composites
- 2.6.11 Self-Healing and Morphing Composites
- 2.6.12 Self-healing ceramics and ceramic composites
- 2.6.13 Self-healing nanomaterials

- 2.6.14 Self-healing biomaterials
- 2.6.15 3d printing of self-healing materials
- 2.6.16 Self-healing under water
 - 2.6.16.1 Approaches
- 2.6.17 Membranes
 - 2.6.17.1 Applications
 - 2.6.17.1.1 Architectural
 - 2.6.17.1.2 Acoustic
 - 2.6.17.1.3 Superhydrophobic Surfaces
 - 2.6.17.1.4 Energy storage and conversion devices
 - 2.6.17.1.5 Desalination
 - 2.6.17.1.6 Filtration membranes
 - 2.6.17.1.7 Kidney Dialysis
 - 2.6.17.1.8 Active ingredients
 - 2.6.17.1.9 Gas Separation
 - 2.6.17.1.10 Vehicle Paint Protection
- 2.6.18 Factors affecting self-healing

3 SELF-HEALING MATERIALS ANALYSIS

- 3.1 Polyurethane clear coats
 - 3.1.1 Properties
 - 3.1.2 Products
 - 3.1.3 Markets
- 3.2 Micro-/nanocapsules
 - 3.2.1 Properties
 - 3.2.2 Manufacturing
 - 3.2.3 Products
 - 3.2.4 Markets
- 3.3 Microvascular networks
 - 3.3.1 Properties
 - 3.3.2 Markets
- 3.4 Ionomers
 - 3.4.1 Properties
 - 3.4.2 Markets
- 3.5 Click polymerization
 - 3.5.1 Properties
 - 3.5.2 Markets
- 3.6 Supramolecular bonding and MSA

- 3.6.1 Properties
- 3.7 Vitrimers
 - 3.7.1 Properties
- 3.8 Self-healing hydrogels
 - 3.8.1 Self-healing mechanisms
 - 3.8.1.1 Hydrogen Bonding
 - 3.8.1.2 Ionic Bonds
 - 3.8.1.3 Host-Guest Interactions
 - 3.8.1.4 Hydrophobic Bonds
 - 3.8.1.5 Imine Bonds
 - 3.8.1.6 Arylhydrazone bonds
 - 3.8.1.7 Diels-Alder Reaction
 - 3.8.2 Types and materials
 - 3.8.2.1 Natural Polymers
 - 3.8.2.2 Synthetic polymers
 - 3.8.2.3 Polyampholyte self-healing hydrogels
 - 3.8.2.3.1 Reversible polymer self-healing hydrogels
 - 3.8.2.4 Peptides
 - 3.8.2.5 Mussel-inspired proteins
 - 3.8.2.6 Bacterial cellulose
 - 3.8.2.7 Conductive polymers
 - 3.8.2.8 Zwitterionic polymers
 - 3.8.2.9 Nanomaterial self-healing hydrogels
 - 3.8.2.9.1 Graphene
 - 3.8.2.9.2 Carbon nanotubes
 - 3.8.2.9.3 Nanoclays
 - 3.8.2.9.4 Silicate nanoparticles
 - 3.8.2.9.5 Magnetic nanoparticles
 - 3.8.3 Markets and applications
- 3.9 Carbon nanotubes
 - 3.9.1 Properties
- 3.10 Graphene and other 2D materials
 - 3.10.1 Properties
- 3.11 Self-healing proteins
 - 3.11.1 Properties
- 3.12 Piezoelectric crystals
- 3.13 Morphing host structures and shapeshifting materials
 - 3.13.1 Overview
 - 3.13.2 Applications

- 3.13.3 Modes of Active Morphing
- 3.13.4 Piezoelectric Actuators
- 3.13.5 Ultraviolet Stimulation
- 3.13.6 Bend-Twist Coupling
- 3.13.7 Electroactive polymer (EAP) composites
- 3.13.8 Morphing Skins
- 3.13.9 Passive Morphing Systems
- 3.13.10 Shape Memory Alloys as Host Materials
- 3.13.11 Active morphing airfoils
- 3.13.12 Active Winglets

4 PATENT ANALYSIS

5 MARKETS FOR SELF-HEALING MATERIALS

- 5.1 Aerospace
 - 5.1.1 Market drivers
 - 5.1.2 Applications
 - 5.1.2.1 Self-healing composites
 - 5.1.2.2 Self-healing thermal interface materials
 - 5.1.3 Commercial activity
 - 5.1.4 SWOT analysis
 - 5.1.5 Revenues
- 5.2 Automotive
 - 5.2.1 Market drivers
 - 5.2.2 Applications
 - 5.2.2.1 Self-healing glass
 - 5.2.2.2 Self-healing coatings for scratch repair
 - 5.2.2.3 Self-healing composites
 - 5.2.2.4 Self-healing tires
 - 5.2.2.4.1 Products
 - 5.2.3 Commercial activity
 - 5.2.4 SWOT analysis
 - 5.2.5 Revenues
- 5.3 Electronics
 - 5.3.1 Market drivers
 - 5.3.2 Applications
 - 5.3.2.1 Colourless polyimides (CPIs)
 - 5.3.2.2 Self-healing displays

- 5.3.2.3 Self-healing consumer electronic device coatings
- 5.3.2.4 Flexile insulators
- 5.3.2.5 Self-healing flexible and stretchable wearables
- 5.3.2.6 Self-healing soft robotics
- 5.3.2.7 6G Reconfigurable Intelligent Surfaces
- 5.3.2.8 Sensors
 - 5.3.2.8.1 Skin Electronics
 - 5.3.2.8.2 Optomechanical Sensors
 - 5.3.2.8.3 Multifunctional Sensors
- 5.3.3 Commercial activity
- 5.3.4 SWOT analysis
- 5.3.5 Revenues
- 5.4 Energy Storage
 - 5.4.1 Overview
 - 5.4.2 Applications
 - 5.4.2.1 Self-healing materials for Lithium batteries
 - 5.4.2.2 Performance limitations and healing capacity
 - 5.4.2.3 Silicon anodes
 - 5.4.2.4 Electrolytes
 - 5.4.2.4.1 Solid-State Batteries
 - 5.4.2.4.2 9. Self-Healing Polymers
 - 5.4.2.5 Capacitors
 - 5.4.2.5.1 Tantalum Capacitors
 - 5.4.2.6 Self-healing flexible batteries
 - 5.4.2.7 Fuel cell membranes
 - 5.4.2.7.1 Types
 - 5.4.2.8 Gas turbine coatings
 - 5.4.2.9 Wind energy
 - 5.4.2.10 Self-healing photovoltaics
 - 5.4.3 Commercial activity
 - 5.4.4 SWOT analysis
 - 5.4.5 Revenues
- 5.5 Elastomers
 - 5.5.1 Market drivers
 - 5.5.2 Applications
 - 5.5.2.1 Self-healing elastomers
 - 5.5.2.2 VPTA vitrimer adhesive
 - 5.5.2.3 Elastomers in robotics
 - 5.5.3 Commercial activity

5.5.4 SWOT analysis

5.5.5 Revenues

5.6 Buildings and construction

5.6.1 Overview

5.6.1.1 Cement

5.6.1.2 Green Cement

5.6.1.3 Cement Decarbonization

5.6.1.4 Ultra High Performance Concrete

5.6.1.5 Bacterial Bio-Concrete

5.6.1.6 Fungal-based self-healing concrete

5.6.1.7 Asphalt

5.6.1.8 Fiber-Reinforced Polymer Construction Materials

5.6.1.8.1 Future Development

5.6.1.8.2 Fiber selection

5.6.1.8.3 Manufacturing methods

5.6.1.8.4 Advanced fiber-reinforced polymers (FRPs)

5.6.1.8.5 Challenges

5.6.2 Market drivers

5.6.3 Applications

5.6.3.1 Intrinsic with additives

5.6.3.2 Bacteria with post treatment

5.6.3.3 Enzymes

5.6.3.4 Funghi

5.6.3.5 Natural polymers

5.6.3.5.1 Materials

5.6.3.6 Self-healing structural ceramics

5.6.3.7 3D Networks

5.6.3.8 Self-healing concrete

5.6.3.8.1 Self-Healing Geopolymer Concrete

5.6.3.8.2 Biological approaches

5.6.3.8.3 Bacteria Coated-Fibers

5.6.3.9 Fiber concrete

5.6.3.10 Self-healing road surfaces and asphalt

5.6.4 Commercial activity

5.6.5 SWOT analysis

5.6.6 Revenues

5.7 Paint and coatings

5.7.1 Market drivers

5.7.2 Applications

- 5.7.2.1 Self-healing anti-corrosion coatings
 - 5.7.2.1.1 Healing mechanisms
 - 5.7.2.1.2 Implementation and challenges
 - 5.7.2.1.3 Silica gel technology
 - 5.7.2.1.4 Approaches
- 5.7.2.2 Epoxy Coatings
- 5.7.2.3 Hydrophobic recovery mechanisms
- 5.7.2.4 Anti-fouling coatings
 - 5.7.2.4.1 Approaches
 - 5.7.2.4.2 Implementation
 - 5.7.2.4.3 Sea slug-inspired smart marine antifouling coatings
- 5.7.2.5 Self-healing polymer film and paint
- 5.7.2.6 Self-healing scratch-resistant coatings
- 5.7.2.7 Icephobic coatings
- 5.7.3 Commercial activity
- 5.7.4 SWOT analysis
- 5.7.5 Revenues
- 5.8 Biomedical and Healthcare
 - 5.8.1 Market drivers
 - 5.8.2 Applications
 - 5.8.2.1 Hydrogels
 - 5.8.2.1.1 Biocompatible polymeric self-healing hydrogels represent
 - 5.8.2.1.2 Super strong self-healing hydrogels
 - 5.8.2.1.3 Wound-Healing Hydrogels
 - 5.8.2.1.4 Polyampholytes Hydrogel
 - 5.8.2.2 Drug or cell delivery carriers
 - 5.8.2.3 Tissue Engineering
 - 5.8.2.3.1 Overview
 - 5.8.2.3.2 Self-Healing Adhesives
 - 5.8.2.4 Electronic Skin
 - 5.8.2.5 Artificial muscle and cartilage
 - 5.8.2.6 Self-healing dental composites
 - 5.8.2.7 Self-healing orthopaedic implants
 - 5.8.2.7.1 Titanium Implants
 - 5.8.2.7.2 Bone Healing and Replacement
 - 5.8.2.7.3 Bone Regeneration
 - 5.8.2.7.4 3D Printed Bone Replacement
 - 5.8.2.8 Artificial human skin
 - 5.8.2.9 Strain biosensors

- 5.8.2.10 Prosthetics and soft robotics
- 5.8.2.11 Bone repair
- 5.8.3 Commercial activity
- 5.8.4 SWOT analysis
- 5.8.5 Revenues
- 5.9 Other markets
 - 5.9.1 Filtration
 - 5.9.1.1 Applications
 - 5.9.1.1.1 Self-healing materials for membrane separation
 - 5.9.1.1.2 Desalination membrane
 - 5.9.1.1.3 Kidney dialysis membrane
 - 5.9.2 Textiles
 - 5.9.2.1 Applications
 - 5.9.2.1.1 Self-healing fabrics
 - 5.9.2.1.2 Programmable Textiles
 - 5.9.3 Military
 - 5.9.3.1 Applications
 - 5.9.3.1.1 Self-healing aircraft
 - 5.9.3.1.2 Self-healing vehicles
 - 5.9.4 Oil and gas
 - 5.9.4.1 Applications
 - 5.9.4.1.1 Corrosion and other protection
 - 5.9.4.1.2 Self-healing metals
 - 5.9.5 Marine
 - 5.9.5.1 Applications
 - 5.9.5.2 Commercial activity
 - 5.9.6 Conductive inks
 - 5.9.7 Optical and photonic materials
 - 5.9.8 Metamaterials
 - 5.9.9 Robotics
 - 5.9.9.1 Overview
 - 5.9.9.2 Integration
 - 5.9.9.3 Self-healing energy harvesting systems

6 COMPANY PROFILES 319 (39 COMPANY PROFILES)

7 RESEARCH METHODOLOGY

8 REFERENCES

List Of Tables

LIST OF TABLES

- Table 1. Applications and Market Opportunity for Self-Healing Materials and Coatings.
- Table 2. Types of Healing by Material Formulation and Format
- Table 3. Spectrum of Self-Healing Capabilities
- Table 4. Technology Roadmap for Self-Healing Material Commercialization by Application.
- Table 5. Trends in self-healing materials.
- Table 6. Commerical stages of Self-Healing Materials by Application
- Table 7. Commercial Self-Healing Products.
- Table 8. The Global Market for Self-Healing Materials 2015-2035 (Millions USD)
- Table 9. The Global Market for Self-Healing Materials by Type 2015-2035 (Millions USD).
- Table 10. The global market for self-healing materials 2015-2035 (Millions USD), by end use market.
- Table 11. The global market for self-healing materials 2015-2035 (Millions USD), by region.
- Table 12. Comparison of Self-Healing Materials with Incumbent Materials by Market Sector.
- Table 13. Self-Healing Options: Operational, Physical, Chemical, Formulation, Format.
- Table 14. Chemical Families in Self-Healing Materials.
- Table 15. Sustainable Intrinsic Self-Healing Materials and Bio-Derived Building Blocks.
- Table 16. Comparison of self-healing systems.
- Table 17. Properties of self-healing polymers.
- Table 18. Types of Polymer Damage to be Healed.
- Table 19. Healing Options for Polymers.
- Table 20. Overview of Self-Healing Mechanisms for Polymers.
- Table 21. Applications of Self-Healing Elastomers.
- Table 22. Self-Healing Metal Systems and Mechanisms.
- Table 23. Applications of Self-Healing and Morphing Composites.
- Table 24. Types of self-healing nanomaterials.
- Table 25. Types and Applications of Self-Healing Biomaterials.
- Table 26. Influencing factors and their effects on healing efficiency.
- Table 27: Companies producing polyurethane clear coat products for self-healing.
- Table 28. Self-healing polyurethane clear coats markets.
- Table 29. Self-Healing Microcapsule Manufacturing Options.
- Table 30. Companies Producing Self-Healing Microcapsules Products.

Table 31. Markets for self-healing micro/nanocapsules .
Table 32. Markets for Microvascular Networks.
Table 33. Click polymerization markets and applications.
Table 34. Supramolecular self-healing materials properties.
Table 35. Vitrimers properties.
Table 36. Self-healing natural polymers.
Table 37. Synthetic polymers.
Table 38. Components, preparation and properties of representative conductive polymer hydrogels.
Table 39. Properties of graphene.
Table 40. Applications of self-healing hydrogels.
Table 41. Properties of graphene.
Table 42. Applications of self-healing piezoelectric crystals.
Table 43. Applications of Morphing host structures and shapeshifting materials.
Table 44. Modes of Active Morphing.
Table 45. Self-Healing Materials Patents Analysis (2010-2024).
Table 46. Self-healing materials and coatings markets and applications.
Table 47. Market drivers for self-healing materials in aerospace.
Table 48. Commercial activity in self-healing aerospace applications.
Table 49. The market for self-healing materials 2015-2035, Millions USD, in the aerospace sector.
Table 50. Market drivers for self-healing materials in the automotive sector.
Table 51. Automotive self-healing tire products.
Table 52. Commercial Activity in Self-Healing Automotive Applications
Table 53. The market for self-healing materials 2015-2035, Millions USD, in the automotive sector.
Table 54. Market drivers for self-healing materials in electronics.
Table 55. Self-Healing Approaches in Electronics.
Table 56. Self-healing Polymer Coatings in Electronics.
Table 57. Self-Healing Soft Robotics Applications.
Table 58. Commercial activity in self-healing electronics applications.
Table 59. The market for self-healing materials, polymers and coatings 2015-2035, Millions USD, in the electronics sector, conservative and high estimates.
Table 60. Commercial activity in self-healing energy applications.
Table 61. The market for self-healing materials 2015-2035, Millions USD, in the energy sector.
Table 62. Market drivers for self-healing materials in elastomers.
Table 63. Types of self-healing elastomers.
Table 64. Commercial activity in self-healing elastomers.

Table 65. The market for self-healing materials, polymers and coatings 2015-2035, Millions USD, in the elastomers sector, conservative and high estimates.

Table 66. Market drivers for self-healing materials in buildings and construction.

Table 67. Bio-based self-healing concrete technologies and companies.

Table 68. Types of self-healing concrete.

Table 69. Commercial activity in self-healing construction applications.

Table 70. The market for self-healing materials 2015-2035, Millions USD, in the construction sector.

Table 71. Market drivers for self-healing materials in paint and coatings.

Table 72. Commercial activity in self-healing paints and coatings applications.

Table 73. The market for self-healing materials and polymers in paints and coatings 2015-2035, Millions USD, in the paints and coatings sector.

Table 74. Market drivers for self-healing materials in healthcare.

Table 75. Applications of Self-Healing Materials in Biomedical and Healthcare.

Table 76. Examples of Adhesive Research for Tissue Engineering.

Table 77. Commercial activity in self-healing healthcare applications.

Table 78. The market for self-healing materials 2015-2035, Millions USD, in the biomedical and healthcare sector.

Table 79. Market drivers for self-healing materials in the oil and gas.

Table 80. Commercial activity in self-healing marine applications.

List Of Figures

LIST OF FIGURES

Figure 1. Sensicrete mechanism of operation.

Figure 2. Scratch Shield.

Figure 3. Commercial readiness of Self-Healing Materials by Application

Figure 4. The global market for self-healing materials 2015-2035 (Millions USD).

Figure 5. The global market for self-healing materials 2015-2035, by coating type (Millions USD).

Figure 6. The global market for self-healing materials 2015-2035 (Millions USD), by end use market.

Figure 7. The global market for self-healing materials 2015-2035 (Millions USD), by region.

Figure 8. SWOT analysis for self-healing materials.

Figure 9. Self-healing using embedded microcapsules.

Figure 10. Schematic of self-healing polymers. Capsule based (a), vascular (b), and intrinsic (c) schemes for self-healing materials. Red and blue colours indicate chemical species which react (purple) to heal damage.

Figure 11. Microcapsule based Self-healing concept.

Figure 12. (a) Different types of vascular networks. (b) Representation of the self-healing concept using microvascular embedment.

Figure 13. Self-healing mechanism in vascular self-healing systems.

Figure 14. Extrinsic self-healing SWOT analysis.

Figure 15. Diels-Alder route for Thermo-reversible crosslinked natural rubber.

Figure 16. Intrinsic self-healing SWOT analysis.

Figure 17. Microcapsule self-healing.

Figure 18. Stages of self-healing mechanism.

Figure 19. Self-healing concept using hollow-fiber embedment

Figure 20. Illustration of BN precipitation on the creep cavity surface in stainless steel.

Figure 21. 3D printed self-healing hydrogels.

Figure 22. Schematic of the self-healing concept using microcapsules with a healing agent inside.

Figure 23. Healing process in a hydrogel.

Figure 24. Chemical and noncovalent interactions behind self-healable hydrogels.

Figure 25. (A) Wound self-healing process (B) Different forms of wound dressings.

Figure 26. Schematic of single-walled carbon nanotube.

Figure 27. Microspheres incorporating self-healing materials.

Figure 28. Flow of self-healing materials into the crack site.

Figure 29. SWOT analysis for self-healing materials in aerospace.

Figure 30. The market for self-healing materials 2015-2035, Millions USD, in the aerospace sector.

Figure 31. Nissan Scratch Shield.

Figure 32. Lamborghini self-healing sports-car.

Figure 33. Self-healing tires.

Figure 34. Michelin's Selfseal technology.

Figure 35. Continental's ContiSeal .

Figure 36. SWOT analysis for self-healing materials in automotive.

Figure 37. The market for self-healing materials 2015-2035, Millions USD, in the automotive sector.

Figure 38. Self-healing patent schematic.

Figure 39. Self-healing coating on glass.

Figure 40. Self-healing dielectric material for wearable electronics.

Figure 41. SWOT analysis for self-healing materials in electronics.

Figure 42. The market for self-healing materials 2015-2035, Millions USD, in the electronics sector.

Figure 43. Schematic of self-healing solar cell.

Figure 44. SWOT analysis for self-healing materials in energy.

Figure 45. The market for self-healing materials 2015-2035, Millions USD, in the energy sector.

Figure 46. Self-healing rubber.

Figure 47. SeRM elastomers.

Figure 48. SWOT analysis for self-healing materials in adhesives and elastomers.

Figure 49. The market for self-healing materials 2015-2035, Millions USD, in the elastomers sector.

Figure 50. Self-healing bacteria crack filler for concrete.

Figure 51. Self-healing concrete.

Figure 52. SWOT analysis for self-healing materials in construction.

Figure 53. The market for self-healing materials 2015-2035, Millions USD, in the construction sector.

Figure 54. SWOT analysis for self-healing materials in paints and coatings.

Figure 55. The market for self-healing materials and polymers in paints and coatings 2015-2035, Millions USD, in the paints and coatings sector.

Figure 56. Dental repair with self-healing microcapsules.

Figure 57. SWOT analysis for self-healing materials in healthcare.

Figure 58. The market for self-healing materials 2015-2035, Millions USD, in the biomedical and healthcare sector.

Figure 59. Self-healing fabrics.

Figure 60. Schematic of the nanocapsule-based self-healing coatings.

Figure 61. Sensicrete compound.

Figure 62. CompPair self-healing prepregs.

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