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# Progresses on Green and Smart Materials for Multifaceted Applications

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## Abstract

Sustainable development is widely known as a critical issue for the future growth and well-being of our society. Technological advancement has provided smart material development opportunities for multifunctional applications in energy, construction, infrastructure, electronics, and building. Green materials are proficient, safe, economically viable, and reliable because of their eco-friendliness and renewable prowess. This paper looks into the progress of natural and resource-efficient materials for smart manufacturing processes that could be used for intelligent application and address contemporary materials' challenges.

## Keywords

- Sustainable development
- Smart materials
- Technological advancement
- Manufacturing processes
- Material development

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## References

• Abi-Akar R, Jones G, Tang Y (2017) Opportunities for sustainable materials management and zero waste in detroit

## **Google Scholar**

• Adams R, Jeanrenaud S, Bessant J, Denyer D, Overy P (2016) Sustainabilityoriented innovation: a systematic review. Int J Manag Rev 18:180–205

## CrossRef Google Scholar

• Addington DM, Schodek DL (2005) Smart materials and new technologies: for the architecture and design professions. Routledge

## **Google Scholar**

• Addington M, Schodek D (2012) Smart materials and technologies in architecture. Routledge

## CrossRef Google Scholar

 Ahmed K, Shiblee MNI, Khosla A, Nagahara L, Thundat T, Furukawa H (2020) Recent progresses in 4D printing of gel materials. J Electrochem Soc 167(3):037563

## CrossRef Google Scholar

 Akhras G (2000) Smart materials and smart systems for the future. Can Military J 1(3):25–31

• Alzahrani A, Petri I, Rezgui Y, Ghoroghi A (2020) Developing smart energy communities around fishery ports: toward zero-carbon fishery ports. Energies 13(11):2779

## CrossRef Google Scholar

• Applications of Smart Materials. Date Accessed October, 21, 2020

## **Google Scholar**

 Ashima R, Haleem A, Bahl S, Javaid M, Mahla SK, Singh S (2021) Automation and manufacturing of smart materials in additive manufacturing technologies using internet of things towards the adoption of industry 4.0. Mater Today: Proc 45:5081–5088

## **Google Scholar**

 Bajpai A, Baigent A, Raghav S, Brádaigh CÓ, Koutsos V, Radacsi N (2020) 4D printing: materials, technologies, and future applications in the biomedical field. Sustainability 12(24):10628

## CrossRef Google Scholar

• Basheer AA (2020) Advances in the smart materials applications in the aerospace industries. Aircr Eng Aerosp Technol 92(7):1027–1035

## CrossRef Google Scholar

 Batra AK, Alomari A (2017) Power harvesting via smart materials. SPIE Press, pp 1–15

## CrossRef Google Scholar

 Bhardwaj AK, Garg A, Ram S, Gajpal Y, Zheng C (2020) Research trends in green product for environment: a bibliometric perspective. Int J Environ Res Public Health 17(8469):1–21

## **Google Scholar**

 Boström M, Andersson E, Berg M, Gustafsson K, Gustavsson E, Hysing E et al (2018) Conditions for transformative learning for sustainable development: a theoretical review and approach. Sustainability 10(12):4479

#### CrossRef Google Scholar

• Bourtsalas A (2019) In: Themelis NJ (ed) Recovery of materials and energy from urban wastes: a volume in the encyclopedia of sustainability science and technology. Springer, New York

## **Google Scholar**

 Cruz DM, Mostafavi E, Vernet-Crua A, Barabadi H, Shah V, Cholula-Díaz JL et al (2020) Green nanotechnology-based zinc oxide (ZnO) nanomaterials for biomedical applications: a review. J Phys: Mater 3(3):034005

## **Google Scholar**

 Čukušić M, Jadrić M, Mijač T (2019) Identifying challenges and priorities for developing smart city initiatives and applications. Croat Oper Res Rev 10(1):117–129

#### CrossRef Google Scholar

• Cunha AG, Gandini A (2010) Turning polysaccharides into hydrophobic materials: a critical review. Part 1. Cellulose. Cellulose 17(5):875–889

## CrossRef Google Scholar

• Dangelico RM (2016) Green product innovation: where we are and where we are going. Bus Strategy Environ 25:560–576

## CrossRef Google Scholar

 Di Rito G, Chiarelli MR, Luciano B (2020) Dynamic modelling and experimental characterization of a self-powered structural health-monitoring system with M.F.C. piezoelectric patches. Sensors 20(4):950

#### CrossRef Google Scholar

• Dineva P, Gross D, Müller R, Rangelov T (2014) Piezoelectric materials. In: Dynamic fracture of piezoelectric materials (pp. 7–32). Springer, Cham

## **Google Scholar**

• Elias MJ (2009) Food in the United States, 1890–1945. ABC-CLIO

#### **Google Scholar**

 Esther L, Piselli A, Faucheu J, Delafosse D, Del Curto B (2014) Smart materials: development of new sensory experiences through stimuli responsive materials. In: 5th S.T.S. Italia conference a matter of design: making society through science and technology (pp 367–382). S.T.S. Italia

#### **Google Scholar**

 Fairman R, Åkerfeldt KS (2005) Peptides as novel smart materials. Curr Opin Struct Biol 15(4):453–463

#### CrossRef Google Scholar

 Farag SG (2019) Application of smart structural systems for smart sustainable cities. In: 2019 4th M.E.C. International Conference on Big Data and Smart City (ICBDSC) (pp 1–5)

## **Google Scholar**

 Fraser AG, Butchart EG, Szymański P, Caiani EG, Crosby S, Kearney P, Van de Werf F (2018) The need for transparency of clinical evidence for medical devices in Europe. Lancet 392(10146):521–530

#### CrossRef Google Scholar

 Gandhi MV, Thompson BD (1992) Smart materials and structures. Springer Science & Business Media

#### **Google Scholar**

 Goldan T, Nistor MC (2019) Reducing self-heating coal stockpile for prevention of environmental hazard. Int Multidiscip Sci GeoConference: SGEM 19(1.3):513–519

## **Google Scholar**

• Haleem A, Javaid M, Singh RP, Suman R (2021) Significant roles of 4D printing using smart materials in the field of manufacturing. Adv Ind Eng Polymer Res

## **Google Scholar**

 Haruna VN, Abdulrahman AS, Zubairu PT, Isezuo LO, Abdulrahman MA, Onuoha DC (2014) Prospects and challenges of composites in a developing country. ARPN J Eng Appl Sci 9(7):1069–1075

• Hu CY, Yoon TR (2018) Recent updates for biomaterials used in total hip arthroplasty. Biomaterials Res 22(1):1–12

## CrossRef Google Scholar

• Karslioğlu A, Balaban E, Onur Mİ (2021) Insulation properties of bricks with waste rubber and plastic: a review. J Nat 1:20–27

## **Google Scholar**

 Kochovski P, Stankovski V (2018) Supporting smart construction with dependable edge computing infrastructures and applications. Autom Constr 85:182–192

## **CrossRef Google Scholar**

 Konarzewska B (2017a) Smart materials in architecture: useful tools with practical applications or fascinating inventions for experimental design. In: I.O.P. Conf series: materials science and engineering, 245, 052098

## **Google Scholar**

• Konarzewska B (2017b) Smart materials in architecture: useful tools with practical applications or fascinating inventions for experimental design. In: I.O.P. Conf series: materials science and engineering (Vol. 245, p. 052098)

## **Google Scholar**

• Krishna JG, Thirumal JR (2015) Application of smart materials in smart structures. Int J Innov Res Sci Eng Technol 4(7)

• Kuhlman T, Farrington J (2010) What is sustainability? Sustainability 2(11):3436–3448

#### CrossRef Google Scholar

• Li VC (2019) High-performance and multifunctional cement-based composite material. Engineering 5:250–260

#### **CrossRef** Google Scholar

• Li X, Su X (2018) Multifunctional smart hydrogels: potential in tissue engineering and cancer therapy. J Mater Chem B 6(29):4714–4730

#### CrossRef Google Scholar

• Li X, Shang J, Wang Z (2017) Intelligent materials: a review of applications in 4D printing. Assem Autom

#### **Google Scholar**

 Mahmoudian M, Sharifikheirabadi P (2019) Uses of new/smart materials in the green building with sustainability concerns. Int Trans J Eng Manag Appl Sci Technol:1–9

#### **Google Scholar**

 Mattern F, Staake T, Weiss M (2010) I.C.T. for green: how computers can help us to conserve energy. In: Proceedings of the 1st international conference on energy-efficient computing and networking (pp 1–10)

#### **Google Scholar**

• Mayeen A, Kalarikkal N (2018) Development of ceramic-controlled piezoelectric devices for biomedical. Fundamental Biomaterials: Ceram 47

## **Google Scholar**

• Mensah J, Casadevall SR (2019) Sustainable development: meaning, history, principles, pillars, and implications for human action: literature review. Cogent Soc Sci 5(1):1653531

## **Google Scholar**

 Mohamed ASY (2017) Smart materials innovative technologies in architecture; towards innovative design paradigm. Energy Procedia 115:139–154

## CrossRef Google Scholar

• Momeni F (2018) 4D Printing as a new paradigm for advanced manufacturing (Doctoral dissertation)

## **Google Scholar**

 Mostafaei A, Elliott AM, Barnes JE, Li F, Tan W, Cramer CL et al (2021) Binder jet 3D printing—process parameters, materials, properties, modeling, and challenges. Prog Mater Sci 119:100707

## CrossRef Google Scholar

• Müller P, Schmid M (2019) Intelligent packaging in the food sector: a brief overview. Foods 8(1):16

## CrossRef Google Scholar

 Nguyen PQ, Courchesne NMD, Duraj-Thatte A, Praveschotinunt P, Joshi NS (2018) Engineered living materials: prospects and challenges for using biological systems to direct the assembly of smart materials. Adv Mater 30(19):1704847

## CrossRef Google Scholar

 Oliveira J, Correia V, Castro H, Martins P, Lanceros-Mendez S (2018) Polymerbased smart materials by printing technologies: improving application and integration. Addit Manuf 21:269–283

## **Google Scholar**

 Pereira Á, Vence X (2012) Key business factors for eco-innovation: an overview of recent firm-level empirical studies. Cuad Gest 12:73–103

## CrossRef Google Scholar

 Rayna T, Striukova L (2021) Assessing the effect of 3D printing technologies on entrepreneurship: an exploratory study. Technol Forecast Soc Chang 164:120483

## CrossRef Google Scholar

 Rosace G, Guido E, Colleoni C, Brucale M, Piperopoulos E, Milone C, Plutino MR (2017) Halochromic resorufin-GPTMS hybrid sol-gel: chemical-physical properties and use as pH sensor fabric coating. Sensors Actuators B Chem 241:85–95

#### CrossRef Google Scholar

• Roy S, Mishra H, Mohapatro BG (2016) Creating sustainable environment using smart materials in smart structures. Indian J Sci Technol 9(30)

#### **Google Scholar**

 Rudrapati R (2020) Graphene: fabrication methods, properties, and applications in modern industries. In: Graphene production and application. IntechOpen, Rijeka, pp 9–22

## **Google Scholar**

• Safiuddin M, Jumaat MZ, Salam MA, Islam MS, Hashim R (2010) Utilization of solid wastes in construction materials. Int J Phys Sci 5(13):1952–1963

## **Google Scholar**

• Salvarli MS, Salvarli H (2020) For sustainable development: future trends in renewable energy and enabling technologies. In: Renewable energy-resources, challenges and applications. IntechOpen

## **Google Scholar**

• Sima V, Gheorghe IG, Subić J, Nancu D (2020) Influences of the industry 4.0 revolution on the human capital development and consumer behavior: a systematic review. Sustainability 12(10):4035

## CrossRef Google Scholar

• Stępień GJ (2020) Internet of things (I.O.T.): smart kitchen appliences for the U.S. market (Doctoral dissertation)

## **Google Scholar**

 Tariq A, Badir YF, Tariq W, Bhutta US (2017) Drivers and consequences of green product and process innovation: a systematic review, conceptual framework, and future outlook. Technol Soc 51:8–23

## CrossRef Google Scholar

• The World Bank (2018) What a waste: an updated look into the future of solid waste management. World Bank

• Wiklund J, Karakoç A, Palko T, Yiğitler H, Ruttik K, Jäntti R, Paltakari J (2021) A review on printed electronics: fabrication methods, inks, substrates, applications and environmental impacts. J Manuf Mater Process 5(3):89

## **Google Scholar**

 Wood J (2008) The top ten advances in materials science. Mater Today 11(1– 2):40–45

## CrossRef Google Scholar

• Yüksek I, Karadayi TT (2017) Energy-efficient building design in the context of building life cycle. Energy Efficient Build:93–123

## **Google Scholar**

 Zakirullin R, Odenbakh I (2020) Chromogenic materials in optical filters for smart windows. In: Novel optical materials and applications (pp JTu4C-19). Optical Society of America

## **Google Scholar**

 Zhang Y, Beggs PJ, McGushin A, Bambrick H, Trueck S, Hanigan IC et al (2020) The 2020 special report of the M.J.A.–lancet countdown on health and climate change: lessons learnt from Australia's "black summer". Med J Aust 213(11):490–492

## CrossRef Google Scholar

• Zhu FB, Zhang CL, Qian J, Chen WQ (2016) Mechanics of dielectric elastomers: materials, structures, and devices. J Zhejiang Univ-Sci A 17(1):1–21

 Zverev VI, Pyatakov AP, Shtil AA, Tishin AM (2018) Novel applications of magnetic materials and technologies for medicine. J Magn Magn Mater 459:182–186

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