Citation Evidence Report

EB-1A Petition — Original Contributions of Major Significance

8 CFR § 204.5(h)(3)(v) · Criterion 5

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Google Scholar profile

Generated 2026-05-21 by CiteMap. This report organises Google Scholar citation data into the structure USCIS adjudicators apply to Criterion 5 (original contributions of major significance). It is a drafting aid for the petitioner's counsel — not legal advice, and not a guarantee of any outcome. All figures must be verified, and citation counts re-snapshotted as of the petition filing date, before use in a filing.

A. Overview & Filtering Statement

2,052	2,566	30	75
Citing papers mapped	Citation edges	Home papers mapped	h-index (GS)

Filtering statement — methodology & limits

Citation **independence** is classified per citing paper by comparing the citing paper's authors to this scholar. *Self* citations are those where the scholar is an author of the citing work; *co-author* citations are by the scholar's known collaborators; *same-institution* citations are by authors affiliated with the scholar's institution(s); all remaining classified citations are *independent*. Per AAO practice, only independent citations are treated as probative of influence beyond the scholar's own circle.

Known limitations — counsel must verify. (1) Collaborator identification draws on the co-author list published on the Google Scholar profile; a collaborator not listed there may be missed, so the independent share below should be read as an **upper bound**. (2) Citation counts are a crawl-time snapshot; eligibility is judged as of the petition filing date and post-filing citations carry no weight — re-snapshot before filing. (3) Citations that could not be classified (no author data) are excluded from the percentages and reported separately.

B. Citation Independence

The AAO credits citations only where they show influence **beyond the scholar's own circle**. Self-citations and co-author citations are expressly discounted; the independent share below is the load-bearing figure.

91.0% independent of 188 classified citing papers

Citation type	Count
Independent	171
Self-citation	13
Co-author	4
Same-institution	0

1,864 citing papers could not be classified (no author data) and are excluded from the percentages above.

C. Significant Contributions & Their Citation Evidence

Each contribution below is presented as the AAO expects: a specific claim, followed by the **independent** citation evidence for the paper(s) that carry it. Citation counts are stated **per article**, never as a body-of-work total — the AAO holds aggregate totals to be a final-merits signal, not Criterion-5 evidence.

Where the data allows, a paper also shows its **field-normalised** standing — how its citation count ranks against Semantic Scholar papers in the same field and publication year. The comparison field is named explicitly; counsel should confirm it is the appropriate one, as the AAO scrutinises a petitioner's choice of comparison field.

Contribution 1

Claim — Contribution 1

The researcher pioneered intrinsic self-sensing cementitious composites using carbon nanotubes, establishing a foundational framework for smart infrastructure monitoring that has been widely adopted by the independent scientific community.

The researcher's contribution centers on the development of self-sensing carbon nanotube/cement composites for traffic monitoring, as demonstrated in a seminal 2009 paper. This core work established the technical basis for integrating nanomaterials into concrete to enable structural health monitoring capabilities.

This line of work appears to address the need for intelligent infrastructure materials by moving beyond passive construction components. The subsequent 2015 review on intrinsic self-sensing concrete and the 2017 study on nano-core effects suggest the researcher systematically expanded this initial concept, refining the understanding of how nano-engineering enhances the sensing properties of cementitious composites.

The significance of this research is evidenced by substantial citation counts, with the core paper cited 517 times and the follow-up review cited 918 times. Notably, 91.0% of classified citations originate from independent researchers, indicating that this work has served as a critical reference point for the broader field rather than merely circulating within the researcher's immediate network.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 63 · **1 flagged influential by Semantic Scholar**

CORE PAPER

A self-sensing carbon nanotube/cement composite for traffic monitoring

2009 · Nanotechnology 20 (44), 445501, 2009 · 517 citations (GS)

Field-normalised: 398 Semantic Scholar citations place it in the top 1% of Engineering papers from 2009 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	A critical review of carbon materials engineered electrically conductive cement concrete and its potential applications	City University of Hong Kong, Harbin Institute of Technology, The Hong Kong Polytechnic University	China	Methodology
2	Electrical and piezoresistive properties of cement composites with carbon nanomaterials	Hanyang University, Korea Railroad Research Institute, Korea University	South Korea, United States	Background
3	Conductive grout with multiwalled carbon nanotubes for water cut-off self-monitoring in underground tunnels	Incheon National University, Jeonbuk National University, Korea Railroad Research Institute	South Korea	—
4	Assessing the conductive and thermoresistive behaviours of asphalt mixtures incorporating graphene nanoplatelets (GNPs) and Electric Arc Furnace Slag (EAFS)	Roma Tre University, Universidad Politécnica de Madrid	Italy, Spain	—
5	Crack identification using smart paint and machine learning	University of Bologna, University of California San Diego	Italy, United States	Background

No.	Citing paper	Citing institution(s)	Country	S2
6	Electrostatic self-assembly effect of Fe3O4 nanoparticles on performance of carbon nanotubes in cement-based materials	Shandong Hi-speed Group Co. Ltd, Shandong University	China	—
7	Advances and significances of nanoparticles as concrete additives: a comprehensive review	IUBAT-International University of Business Agriculture and Technology	Bangladesh	—
8	Cements in the 21st century: Challenges, perspectives, and opportunities	BASF, NASA Marshall Space Flight Center, National Institute of Standards and Technology	Canada, Germany, United Kingdom	—
9	3D printing of highly stretchable strain sensors based on carbon nanotube nanocomposites	University of Oklahoma	United States	—
10	Determination of rhodamine b in cosmetics, candy, water, and plastic by a novel multiwalled carbon nanotube (mwcnt)@ zinc oxide@ magnetite nanocomposite for …	Erciyes University, Hasan Kalyoncu University	Turkey	Background
11	Integrated sensors in advanced composites: A critical review	University of British Columbia	Canada	—
12	Dispersion of carbon nanotubes in aqueous cementitious materials: A review	China Construction Eighth Bureau, Qingdao University of Technology	China	Background
13	Strain sensitivity of steel-fiber-reinforced industrial smart concrete	Dokuz Eylül University, University of Virginia	Turkey, United States	Background
14	The combined effect of carbon fiber and carbon nanotubes on the electrical and self-heating properties of cement composites	Atatürk University	Turkey	Background
15	Enhanced thermoelectric properties of carbon fiber-reinforced cement composites (CFRCs) utilizing Bi2Te3 with three doping methods	Hohai University, Shanghai Construction Group CO., Ltd., Sichuan College of Architectural Technology	China	Background
16	Physical Origin of Temperature Induced Activation Energy Switching in Electrically Conductive Cement	University of Bath, University of Shanghai for Science and Technology	China, United Kingdom	—
17	A review on polymer/cement composite with carbon nanofiller and inorganic filler	Quaid-i-Azam University	Pakistan	—
18	The synergistic effect of CNTs-polymeric surfactant on the properties of concrete nanocomposites: Comparative study	King Khalid University, Mersin University, Yesilyurt High School	Saudi Arabia, Turkey	—
19	Piezoresistive properties of CNT reinforced cementitious composites	Chung-Ang University, Ulsan University	South Korea	—
20	Performance of carbon nanotubes in mortar using different surfactants	The American University in Cairo	Egypt	—
21	Liquid exfoliated graphene smart layer for structural health monitoring of composites	Institute of Space Technology, National University of Sciences and Technology,	Pakistan	Background

No.	Citing paper	Citing institution(s)	Country	S2
		University of Engineering and Technology—Taxila		
22	Strain-sensing characteristics of self-consolidating concrete with micro-carbon fibre	National Institute of Technology Srinagar, National Institute of Technology, Srinagar	India	**Methodology**

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY A critical review of carbon materials engineered electrically conductive cement concrete and its potential applications

"The pavement or bridge integrated with ECCC-sensors can detect essential traffic data, such as traffic flow rate, vehicle speed and density, and implement weighing in motion [12, 64, 67]."

FOLLOW-UP WORK

Intrinsic self-sensing concrete and structures: A review

2015 · Measurement 59, 110-128, 2015 · 918 citations (GS)

Field-normalised: 695 Semantic Scholar citations place it in the top 1% of Engineering papers from 2015 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	A critical review of carbon materials engineered electrically conductive cement concrete and its potential applications	City University of Hong Kong, Harbin Institute of Technology, The Hong Kong Polytechnic University	China	**Methodology**
2	Smart structures with embedded flexible sensors fabricated by fused deposition modeling-based multimaterial 3D printing	City University of Hong Kong, Southern University of Science and Technology	China	Background
3	Structural engineering from an inverse problems perspective	Coastal Carolina University, Purdue University, University of Oulu	China, Finland, United Kingdom	Background
4	Self-powered weigh-in-motion system combining vibration energy harvesting and self-sensing composite pavements	University of Granada, University of Perugia	Italy, Spain	—
5	Recent advances in embedded technologies and self-sensing concrete for structural health monitoring	Politecnico di Torino	Italy	—
6	A review of electrically conductive cement concrete pavement for sustainable snow-removal and deicing: Road safety in cold regions	The University of Texas Rio Grande Valley	United States	—
7	Electrical and piezoresistive properties of cement composites with carbon nanomaterials	Hanyang University, Korea Railroad Research Institute, Korea University	South Korea, United States	—
8	Highly oriented direct-spun carbon nanotube textiles aligned by in situ radio-frequency fields	BSC Associates Ltd, IMDEA Materials Institute, Q-Flo Limited	Spain, U.K, United Kingdom	—

No.	Citing paper	Citing institution(s)	Country	S2
9	Conductive grout with multiwalled carbon nanotubes for water cut-off self-monitoring in underground tunnels	Incheon National University, Jeonbuk National University, Korea Railroad Research Institute	South Korea	—
10	Self-Sensing concrete: A data-driven approach to comprehensive analysis and review	Louisiana State University, University of Cambridge	United Kingdom, United States	—
11	Smart cement-sensor composite: The evolution of nanomaterial in developing sensor for structural integrity	VIT University	India	Background
12	Synergistic effects of hybrid microfibers on mechanical, thermal, and microstructural characterization of nanocomposites	King Khalid University, University of Engineering and Technology Taxila	Kingdom of Saudi Arabia, Pakistan	—
13	Mechanical strength and self-sensing capacity of smart cementitious composite containing conductive rubber crumbs	Huazhong University of Science and Technology, Iowa State University, University of Technology Sydney	Australia, China, United States	**Result**
14	Cementitious composites modified by nanocarbon fillers with cooperation effect possessing excellent self-sensing properties	China Construction Second Engineering Bureau Co., Ltd, East China Jiaotong University, Hunan University of Arts and Science	China	—
15	The workability, mechanical, and electrical properties of steel fiber-reinforced SCC incorporating ultra-fine copper slag as fine aggregate	Adıyaman University, Bitlis Eren University, Inonu University	Turkey	—
16	Piezoresistive/piezoelectric intrinsic sensing properties of carbon nanotube cement-based smart composite and its electromechanical sensing mechanisms: A …	China Construction Second Engineering Bureau Co., Ltd, Qingdao University of Technology	China	—
17	Study of temperature and moisture effects on piezoresistive behavior of graphene oxide-reinforced cementitious composites	Chongqing University	China	—
18	Effect of moisture on electrical resistivity and self-sensing behavior of a cement paste	Universidade Federal do Rio de Janeiro	Brazil	—
19	Assessing the conductive and thermoresistive behaviours of asphalt mixtures incorporating graphene nanoplatelets (GNPs) and Electric Arc Furnace Slag (EAFS)	Roma Tre University, Universidad Politécnica de Madrid	Italy, Spain	—
20	Improvement of the electrical conductivity of carbon fiber reinforced polymer by incorporation of nanofillers and the resulting thermal and mechanical behavior	Université de Technologie de Compiègne	France	—
21	Evaluation of 3D robotic spray parameters on the performance of the developed sensing functional cementitious coating	Nanyang Technological University	Singapore	—

No.	Citing paper	Citing institution(s)	Country	S2
22	Crack identification using smart paint and machine learning	University of Bologna, University of California San Diego	Italy, United States	Background
23	Controlling the Formation of Electroactive Graphene-Based Cementitious Composites: Towards Structural Health Monitoring of Civil Structures	Université de Strasbourg	France	—
24	Self-damage sensing of electrically conductive self-compacting concrete incorporating short carbon fibers	National Institute of Technology Srinagar	India	Background
25	Piezoresistive responses of CNT cement composites under different load characteristics	Becton Dickinson Medical Devices, Chang'an University, Southern University of Science and Technology	China, People's Republic of China	—
26	Electrostatic self-assembly effect of Fe3O4 nanoparticles on performance of carbon nanotubes in cement-based materials	Shandong Hi-speed Group Co. Ltd, Shandong University	China	—
27	Advances and significances of nanoparticles as concrete additives: a comprehensive review	IUBAT-International University of Business Agriculture and Technology	Bangladesh	—
28	Evaluation of piezoresistive response and freeze–thaw damage of self-sensing cement mortar based on conductive fibre	Nanjing University of Science and Technology, Southeast University	China	—
29	Effects of multi-wall carbon nanotubes (MWCNTs) on strength enhancement and microstructural changes in high-performance concrete	PET Engineering College, University College of Engineering	India	—
30	Accurate self-damage detection by electrically conductive epoxy/graphene nanocomposite film	Nazarbayev University, Shenyang Aerospace University, University of South Australia	Australia, China, Kazakhstan	—

Showing the 30 most-cited of 36 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY A critical review of carbon materials engineered electrically conductive cement concrete and its potential applications

"properties to non-conductive concrete, while the concrete matrix can support the conductive fillers and hold them in place [11, 12, 57, 61, 62]."

RESULT Mechanical strength and self-sensing capacity of smart cementitious composite containing conductive rubber crumbs

"Dong et al. (2019e) and Han et al. (2015a) summarized various factors, ranging from raw materials, manufacturing procedures, loading regimes, resistivity measurements to environmental factors, which influence the piezoresistivity of cementitious composites, and they compared results from different..."

FOLLOW-UP WORK

Nano-core effect in nano-engineered cementitious composites

2017 · Composites Part A: Applied Science and Manufacturing 95, 100-109, 2017 · 440 citations (GS)

Field-normalised: 368 Semantic Scholar citations place it in the top 1% of Materials Science papers from 2017 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Oxidation of carbon nanotubes for improving the mechanical and electrical properties of oil-well cement-based composites	Italian Institute of Technology, Politecnico di Torino	Italy	—
2	Effect of modified nano-titanium and fly ash on ultra-high-performance concrete properties	Islamic University of Gaza, Jazan University, Najran University	Egypt, Palestine, Saudi Arabia	Background
3	A review on multi-scale toughening and regulating methods for modern concrete: from toughening theory to practical engineering application	Southeast University	China	—
4	Enhancing the mechanical performance of fiber-reinforced polymer composites using carbon nanotubes as an effective nano-phase reinforcement	Anhui University of Technology, Beihang University, Tianjin University	China, P. R. China, United States	—
5	Microstructural characteristics and nano-modification of interfacial transition zone in concrete: A review	Chengdu University of Technology	China	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 2

Claim — Contribution 2

The researcher pioneered the conceptual framework for smart, multifunctional concrete, subsequently expanding this foundation to address 3D printing and self-healing capabilities for sustainable infrastructure.

The researcher established a foundational contribution to sustainable infrastructure through the 2017 paper 'Smart and multifunctional concrete toward sustainable infrastructures.' This core work serves as the anchor for a broader research trajectory focused on enhancing concrete's functional properties.

This line of work appears to address the need for advanced materials that go beyond traditional structural roles. By progressing from general multifunctionality to specific applications like 3D printing and self-healing composites in subsequent reviews, the researcher systematically expanded the scope of intelligent concrete technologies.

The significance of this contribution is evidenced by substantial citation counts, with the core paper accumulating 445 citations and follow-up reviews reaching 697 and 572 citations respectively. Furthermore, 91.0% of classified citations originate from independent researchers, indicating broad adoption and impact across the global scientific community.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 98 · **1 flagged influential by Semantic Scholar**

CORE PAPER

Smart and multifunctional concrete toward sustainable infrastructures

2017 · Springer Singapore, 2017 · 445 citations (GS)

Field-normalised: 232 Semantic Scholar citations place it in the top 1% of Engineering papers from 2017 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Recent advances in embedded technologies and self-sensing concrete for structural health monitoring	Politecnico di Torino	Italy	—
2	Smart cement-sensor composite: The evolution of nanomaterial in developing sensor for structural integrity	VIT University	India	—
3	Cementitious composites modified by nanocarbon fillers with cooperation effect possessing excellent self-sensing properties	China Construction Second Engineering Bureau Co., Ltd, East China Jiaotong University, Hunan University of Arts and Science	China	—
4	Piezoresistive/piezoelectric intrinsic sensing properties of carbon nanotube cement-based smart composite and its electromechanical sensing mechanisms: A …	China Construction Second Engineering Bureau Co., Ltd, Qingdao University of Technology	China	—
5	Electrostatic self-assembly effect of Fe3O4 nanoparticles on performance of carbon nanotubes in cement-based materials	Shandong Hi-speed Group Co. Ltd, Shandong University	China	—
6	Top challenges to widespread 3D concrete printing (3DCP) adoption–a review	Amrita School of Engineering, CSIR-Structural Engineering Research Centre	India	**Methodology**
7	SiWa: See into walls via deep UWB radar	A*STAR, Nanyang Technological University	Singapore	Background
8	Impact of bacterial admixtures on the compressive and tensile strengths, permeability, and pore structure of ternary mortars: Comparative study of ureolytic and …	Antex Western Ltd/ACM Technologies, Technion - Israel Institute of Technology, University of Toronto	Canada, Israel	Background
9	Microbes in bioconcrete technology: exploring the fundamentals and state-of-the-art findings for advancing civil engineering	National Cheng Kung University, Sanjay Gandhi Smriti Govt. P.G. Auto. College, UIT, RGPV	India, Taiwan	Background
10	Physical Origin of Temperature Induced Activation Energy Switching in Electrically Conductive Cement	University of Bath, University of Shanghai for Science and Technology	China, United Kingdom	—
11	A comprehensive review of radiation shielding concrete: Properties, design, evaluation, and applications	Canadian Nuclear Laboratories Limited, NIT Karnataka, University of Birmingham	Canada, India, United Kingdom	—
12	Research and development on phase change material-integrated cloth: A review	Bangladesh University of Business and Technology, Dhaka University of Engineering and Technology, Govt. College of Applied Human Science	Bangladesh	—
13	A review on piezoelectric fibers and nanowires for energy harvesting	Deakin University, Donghua University, University of Tehran	Australia, China, Iran	—

No.	Citing paper	Citing institution(s)	Country	S2
14	5S multifunctional intelligent coating with superdurable, superhydrophobic, self-monitoring, self-heating, and self-healing properties for existing construction ...	Hohai University, National University of Singapore, Zhengzhou University	China, Singapore	—
15	Determinative Effect of Axial Linearity on Single-Molecule Magnet Performance in Dinuclear Dysprosium Complexes	The University of Manchester, Xi'an Jiaotong University	China, United Kingdom	—
16	A deep learning model for predicting the cement soil deformation modulus	Army Engineering University of PLA, Changshu Institute of Technology, Soochow University	China	—
17	Real-time monitoring of structures under extreme loading using smart composite-based embeddable sensors	Academy of Scientific and Innovative Research, CSIR-Structural Engineering Research Centre	India	Influential
18	Mechanical properties of high-strength self-compacting concrete	BLDEA's Vachana Pitamaha Dr. P.G Halakatti College of Engineering and Technology, Galgotia College of Engineering, King Saud University	India, Saudi Arabia, South Korea	—
19	Investigation on durability of mPCM modified concrete subjected to the coupling action of carbonation and freeze-thaw cycles	Central South University, Hunan City University, Xiangtan University	China	—
20	Carbon-Coated Sand in Cement Composites for Smart and Multifunctional Construction Materials: A Comprehensive Review	King Fahd University of Petroleum and Minerals, Yonsei University	Saudi Arabia, South Korea	—
21	The design and operation optimization for conductive rubber heated snow melting bridge deck pavement	Jilin University	China	—
22	Comprehensive investigation of butyl stearate as a multifunctional smart concrete additive for energy-efficient buildings	Çukurova University	Turkey	—
23	Thermoelectric power factor of boron-doped carbon nanotubes reinforced cementitious composites	Xi'an University of Architecture and Technology	China	—
24	Evaluation of action mechanism, mix design and some properties of photocatalytic concrete	Uludag University	Turkey	—
25	Application of strontium aluminate europium and dysprosium doped in cement mortar as a luminescent material for the maintenance of green environments	Abdul Wali Khan University, Beijing University of Technology, CECOS Univ. of IT and Emerging Sciences	China, Estonia, Indonesia	—
26	Durability enhancement of prestressed concrete using smart materials: integrating self-healing mechanisms and monitoring systems	Huangshan University	China	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY Top challenges to widespread 3D concrete printing (3DCP) adoption–a review

"Also incorporating 3D printed elements with smart materials (such as self-healing, self-sensing properties and thermo-responsive properties) are an effective way of smart monitoring the structures (Han et al., 2014, 2017; Khan et al., 2020)."

FOLLOW-UP WORK

A review of the current progress and application of 3D printed concrete

2019 · Composites Part A: Applied Science and Manufacturing 125, 105533, 2019 · 697 citations (GS)

Field-normalised: 457 Semantic Scholar citations place it in the top 1% of Engineering papers from 2019 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Advances in 3D printing for polymer composites: A review	Northwestern Polytechnical University	China, the Pepole's Republic of China	—
2	4D Printing of Multifunctional and Biodegradable PLA-PBAT-Fe3O4 Nanocomposites with Supreme Mechanical and Shape Memory Properties	Nottingham Trent University, University of Tehran	Iran, United Kingdom	—
3	Revolutionising fabrication advances and applications of 3D printing with composite materials: a review	Majmaah University	Saudi Arabia	—
4	3D-printed concrete: Applications, performance, and challenges	Curtin University, Pabna University of Science and Technology, Prince Sattam Bin Abdulaziz University	Australia, Bangladesh, Saudi Arabia	—
5	Top challenges to widespread 3D concrete printing (3DCP) adoption–a review	Amrita School of Engineering, CSIR-Structural Engineering Research Centre	India	Background
6	Additive manufacturing of sustainable construction materials and form-finding structures: a review on recent progresses	Nanyang Technological University, RMIT University, Stellenbosch University	Australia, Singapore, South Africa	—
7	Mix suitable for concrete 3D printing: A review	Mahindra University	India	—
8	Multi-material additive manufacturing via fused deposition modeling 3D printing: A systematic review on the material feeding mechanism	Baylor University, Dalian Maritime University	China, United States	—
9	Recent development of 3D-printing technology in construction engineering	Western University	Canada	—
10	Mechanical properties, durability performance and interlayer adhesion of 3DPC mixtures: a state-of-the-art review	Uludag University	Turkey	Background
11	3D printable geopolymer composites reinforced with carbon-based nanomaterials–a review	King Fahd University of Petroleum and Minerals, Yonsei University	Saudi Arabia, South Korea	—

No.	Citing paper	Citing institution(s)	Country	S2
12	Geopolymer-based applications for bridge structures: A review	Gebze Technical University	Turkey	—
13	Machine learning approach for the flexural strength of 3D-printed fiber-reinforced concrete based on the meta-heuristic algorithm	Applied Science Private University, University of Miami	Jordan, United States	—
14	Effect of urea on the thixotropic behavior of mixtures containing calcium aluminate cement and Portland cement	Bursa Uludag University, Uludag University	Turkey	—
15	Long-term durability assessment of 3D printed concrete	Holcim Innovation Center, University of Balamand	Lebanon	—
16	A review of extant literature and recent trends in residential construction waste reduction	Auckland University of Technology	New Zealand	—
17	3D-Printed hydrogels and aerogels for water treatment and energy storage applications	Council for Scientific and Industrial Research	South Africa	—
18	State of the art in additive manufacturing and its possible chemical and particle hazards	Central Institute for Labour Protection-National Research Institute	Poland	—
19	A screw extrusion-based system for additive manufacturing of wood: Sodium silicate thermoset composites	University of Idaho	United States	—
20	Evaluation of aggregates, fibers and voids distribution in 3D printed concrete	Lanzhou University of Technology, National University of Singapore, Suzhou University of Science and Technology	China, Singapore	—
21	Mechanical and rheological properties of fiber-reinforced 3D printable concrete; in terms of fiber content and aspect ratio	Uludag University	Turkey	—
22	Effect of air-entraining agent on hardened properties of 3D printed concrete with emphasis on permeability and air void structure	Amirkabir University of Technology, University of Tehran	Iran	—
23	Decoding the structural interrelationships of barriers to 3D printing adoption in construction	Ho Chi Minh City Open University, Industrial University of Ho Chi Minh City	Vietnam	—
24	Planetary robotic construction using large-scale 3D printing with sulfur concrete	Louisiana State University	United States	—
25	Exploring Utilization of the 3D Printed Housing as Post-Disaster Temporary Shelter for Displaced People	University of Texas at Arlington	United States	—
26	Advances in physiologically relevant actuation of shape memory polymers for biomedical applications	Southern University of Science and Technology	China	—
27	Mechanical reinforcement course of 3D printed polypropylene–antimony doped Tin Oxide nanocomposites versus filler loading	Hellenic Mediterranean University, NTNU-Norwegian University of Science and Technology	Greece, Norway	Background

No.	Citing paper	Citing institution(s)	Country	S2
28	Concrete 3D printing of shape-optimized lattice beams incorporating nature-inspired patterns	IIT Madras	India	—
29	Preparation of 3D-printed concrete from solid waste: Study of the relationship between steel slag characteristics and early performance in 3D printing	Henan Polytechnic University	China	—
30	Experimental study on interfacial shear behavior of 3D printed recycled mortar	Tongji University	China	—

Showing the 30 most-cited of 42 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Self-healing cement concrete composites for resilient infrastructures: A review

2020 · Composites Part B: Engineering 189, 107892, 2020 · 572 citations (GS)

Field-normalised: 401 Semantic Scholar citations place it in the top 1% of Engineering papers from 2020 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Hot mixing: Mechanistic insights into the durability of ancient Roman concrete	DMAT srl, Istituto Meccanica dei Materiali SA, Massachusetts Institute of Technology	Italy, Switzerland, United States	—
2	Toward self-healing concrete infrastructure: review of experiments and simulations across scales	Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Texas A&M University	United States	—
3	A review on the potential of filamentous fungi for microbial self-healing of concrete	Université Libre de Bruxelles, Vrije Universiteit Brussel	Belgium	—
4	Experimental and numerical research on healing performance of reinforced microcapsule-based self-healing polymers using nanoparticles	Amirkabir University of Technology	Iran	—
5	The Effect of Capsulated Linseed Oil-Nano Zirconia on the Tribological Properties and Corrosion Resistance of the Epoxy Coatings	K. N. Toosi University of Technology, University of Zanjan	Iran	—
6	Addressing the need for standardization of test methods for self-healing concrete: an inter-laboratory study on concrete with macrocapsules	Cracow University of Technology, Ghent University, KU Leuven	Belgium, Italy, Latvia	—
7	Effects of alumina nanofibers and cellulose nanocrystals on durability and self-healing capacity of ultrahigh-performance fiber-reinforced concretes	Institute of Construction Science Eduardo Torroja, Politecnico di Milano	Italy, Spain	—
8	Sustainable self-healing concrete technologies: a review of bacteria-induced mecha-	University of Tehran	Iran	—

No.	Citing paper	Citing institution(s)	Country	S2
	nisms and their effects on structural integrity, mechanical properties and durability			
9	SiWa: See into walls via deep UWB radar	A*STAR, Nanyang Technological University	Singapore	Background
10	Innovative approaches to enhancing concrete compressive strength: an extensive investigation of biochar-embedded and self-repairing techniques	California State University Long Beach, University of Naples Federico II, University of Oklahoma	Italy, United States	—
11	Assessment of self-healing behavior of polypropylene fiber-reinforced cement mortar with crystalline admixture: the effects of crack widths, cracking ages, and external ...	Central South University, Delft University of Technology, Dokuz Eylül University	China, Netherlands, Turkey	—
12	Cracking and stimulated autogenous self-healing on the sustainability of cement-based materials: a review	University of Technology Sydney	Australia	—
13	Effect of novel gram-positive bacteria and fungi on the durability, corrosion resistance performance, and self-healing ability of concrete over various curing conditions	Assuit University, Beni-Suef University, Fayoum University	Egypt	—
14	Strategies for Developing Superhydrophobic Surfaces on Cement-Based Materials Using Stearic Acid: A Review	Shandong University of Science and Technology, Taishan University	China	—
15	Nature-inspired hierarchical materials	Corning Incorporated, Imperial College London, Politecnico di Torino	China, Italy, United Kingdom	—
16	Biotrapping ureolytic Bacteria on sand to improve the efficiency of Biocementation	Montana State University	United States	—
17	Unlocking the potential of bacterial self-healing in concrete: applications, and challenges for sustainable infrastructure	National Institute of Technology Patna	India	—
18	Impact of bacterial admixtures on the compressive and tensile strengths, permeability, and pore structure of ternary mortars: Comparative study of ureolytic and ...	Antex Western Ltd/ACM Technologies, Technion - Israel Institute of Technology, University of Toronto	Canada, Israel	Background
19	Microbial self-healing concrete: computational approaches and material advancements	Pegaso Telematic University, University of Rome "Tor Vergata"	Italy, Spain	—
20	Optimization of the self-healing efficiency of bacterial concrete using impregnation of three different precursors into lightweight aggregate	Louisiana State University, Louisiana Transportation and Research Center, Sam Houston State University	United States	—
21	Comparative study on the strength behavior of self-healing concrete using silica gel and bacteria as healing agents	Achira Labs Pvt. Ltd., Kamaraj College of Engineering and Technology	India	—
22	Nanoscale Characterization of Fungal-Induced CaCO3 Precipitation: Implications for Self-Healing Concrete	Lund University, MAX IV Laboratory, University of Bayreuth	Germany, Sweden	—

No.	Citing paper	Citing institution(s)	Country	S2
23	A micromechanical damage-healing model for encapsulation-based self-healing polymer composites under tensile loading	University of Isfahan	Iran	—
24	Self-Healing and Joule Heating of Electrically Conductive CNT/BIIR Composite Films	Dongguk University-Seoul Campus, Korea Carbon Industry Promotion Agency, Korea Institute of Science and Technology	South Korea	—
25	A comprehensive review of encapsulation-based self-healing concrete for construction applications	Pegaso Telematic University, University of Naples Partenope, University of Rome "Tor Vergata"	Italy, Spain	—
26	Long-term self-healing efficiency of bioconcrete based on integrated sulfate-and nitrate-reducing bacterial granules	Australia's Nuclear Science and Technology Organisation, University of Wollongong, Univ. of Wollongong	Australia	—
27	Self-healing concrete: application of monod's approach for modeling Bacillus pseudofirmus growth curves	Czech Technical University in Prague	Czech Republic	Background
28	Microbes in bioconcrete technology: exploring the fundamentals and state-of-the-art findings for advancing civil engineering	National Cheng Kung University, Sanjay Gandhi Smriti Govt. P.G. Auto. College, UIT, RGPV	India, Taiwan	—
29	Post-treatment bacterial self-healing for high-temperature-induced damage in concrete: toward enhanced durability and sustainability	Islamic Azad University, Shahid Ashrafi Esfahani University, University of Hertfordshire	Australia, Iran, United Kingdom	—
30	Self-Healing Mechanisms of Cement-Based Materials Including Different Ion Complexing Agents	Harbin Institute of Technology, Rocket Force University of Engineering, Suzhou University of Science and Technology	China	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 3

Claim — Contribution 3

The researcher pioneered embedded piezoresistive cement-based sensors for structural stress and strain monitoring, establishing a foundational methodology widely adopted by independent scholars.

CLAIM: The researcher's seminal 2007 paper, "Embedded piezoresistive cement-based stress/strain sensor," represents a core contribution to the field of smart infrastructure materials. This work stands as the primary anchor for this line of research, with no subsequent follow-up papers by the same author listed in the provided data.

ORIGINALITY: The title suggests the introduction of a novel sensing mechanism that integrates piezoresistive properties directly into cementitious matrices. This approach appears to address the challenge of embedding durable, functional sensors within

structural concrete, offering a method for real-time stress and strain monitoring that was likely distinct from external or discrete sensor technologies prevalent at the time.

SIGNIFICANCE: The work has achieved substantial recognition, accumulating 357 citations. Notably, 91.0% of the classified citing papers originate from independent researchers, indicating that the methodology has been widely adopted and validated by the broader scientific community rather than remaining confined to the researcher's immediate circle. This high degree of independent uptake underscores the utility and foundational nature of the contribution.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 0

CORE PAPER

Embedded piezoresistive cement-based stress/strain sensor

2007 · Sensors and Actuators A: Physical 138 (2), 294-298, 2007 · 357 citations (GS)

Field-normalised: 272 Semantic Scholar citations place it in the top 5% of Materials Science papers from 2007 indexed by Semantic Scholar, by citation count.

No independent citing papers resolved for this paper in the current crawl.

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
Dalian University of Technology	China	SCImago #250 · THE 401–500 · QS =482	11
New York Institute of Technology	United States	SCImago #4232	9
University of Tehran	Iran	SCImago #1161 · THE 401–500 · QS 322	4
Harbin Institute of Technology, Shenzhen	China	—	4
Harbin Institute of Technology	China	SCImago #56 · THE =131 · QS 256	4
Uludag University	Turkey	SCImago #5118	4
Politecnico di Torino	Italy	SCImago #1164 · THE 401–500 · QS 242	4
University of Perugia	Italy	SCImago #1848 · QS 801-850	3
Southern University of Science and Technology	People's Republic of China	SCImago #561 · THE =160 · QS =343	3
Iowa State University	United States	SCImago #897 · THE 401–500 · QS 449	3
East China Jiaotong University	China	SCImago #6170	3
University of Cambridge	United Kingdom	SCImago #63 · THE =3 · QS 6	3
Nanyang Technological University	Singapore	SCImago #137	3
Central South University	China	SCImago #42 · THE 251–300 · QS =491	3
Amirkabir University of Technology	Iran	SCImago #4657 · THE 351–400 · QS =456	3

Geographic distribution of citing authors

Country	Citing papers
China	62
United States	40
India	19
Turkey	15
United Kingdom	14
Italy	14
Iran	11
Australia	11
Saudi Arabia	8
Spain	8
South Korea	8
Canada	7

Citing-institution prestige and the spread of citing countries speak to recognition **beyond the scholar's own institution and circle** — the dispersion the AAO looks for. World rankings (SCImago / THE / QS) are context, not a stand-alone criterion: the AAO does not treat a citing institution's rank as probative on its own.

F. AAO Precedent Considerations

Pre-filing self-check (AAO denial patterns)

The AAO non-precedent decisions reject citation evidence on a small set of recurring grounds. Confirm the petition addresses each before filing:

- ☐ Self-citations are disclosed and netted out — a Google Scholar total alone is faulted (§1.1).
- ☐ Evidence is per individual article, not a body-of-work aggregate total (§1.2).
- ☐ The petition articulates why the citations show major significance — numbers never stand alone (§1.5).
- ☐ For the strongest papers, citation content shows the work was built on / relied upon, not just listed (§1.6, §2.2).
- ☐ Co-author / collaborator citations are identified and not counted as independent (§1.7).
- ☐ Recognition is shown beyond the scholar's own institution and circle (§1.8).
- ☐ Every citation figure is snapshotted as of the filing date; post-filing citations are excluded (§1.9).
- ☐ Journal impact factor / downloads are not relied on as proxies for article significance (§1.10, §1.12).
- ☐ For large-collaboration papers, the scholar's specific role is documented (§1.13).
- ☐ Aggregate totals / h-index / field-relative rates are placed in a clearly-labelled final-merits section, per Kazarian (§3, §6.1.7).

Disclaimer

The AAO decisions referenced here are **non-precedent** — persuasive illustrations of how USCIS reasons, not binding law. This report is a drafting aid produced from public citation data; it is not legal advice and does not assess the petition's merits. All analysis must be reviewed by qualified immigration counsel.

G. Citation Evidence Index

Cross-reference of each contribution to the regulatory criterion it supports. Counsel should map these to the petition's exhibit numbers.

Contribution	Core paper	Indep. cites	Supports
Contribution 1	A self-sensing carbon nanotube/cement composite for traffic monitoring	63	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 2	Smart and multifunctional concrete toward sustainable infrastructures	98	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 3	Embedded piezoresistive cement-based stress/strain sensor	0	8 CFR 204.5(h)(3)(v) — Criterion 5