Dr. Zoi S. Metaxa

Associate Professor

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POSITION
Associate Professor
Department of Chemistry, Democritus University of Thrace, Kavala

RESEARCH INTERESTS
Materials Science, Nanotechnology, Advanced Composite and Nanocomposite Materials

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EDUCATION

2012 **PhD in Advanced Nanocomposite Materials,** School of Civil Engineering, Democritus University of Thrace

2007 **Master's Degree in New Materials,** School of Civil Engineering, Democritus University of Thrace

2005 **Bachelor's Degree in Civil Engineering,** School of Civil Engineering, Democritus University of Thrace

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TEACHING

09/2025 – today **Associate Professor,** Department of Chemistry, Democritus University of Thrace, Kavala

09/2019 – 09/2025 **Assistant Professor,** Department of Chemistry, Democritus University of Thrace, Kavala

Undergraduate courses:

- Materials Characterization (Theory +Laboratory)
- Inorganic Materials Chemistry
- Strength of Materials (Theory +Laboratory)
- English I
- English II

Undergraduate courses:

- Research Methodology (MPhil in Nanotechnology and MSc Cosmetic chemistry)
- Nanotechnology – Nanomaterials (MPhil in Nanotechnology)
- Industrial Applications (MPhil in Nanotechnology)
- Risk Analysis and Manufacturing Cost, under course B 500: Reservoir Simulation (MSc in Oil and Gas Technology)
- Oil well cementing (MSc in Oil and Gas Technology)
- Manufacturing Cost (MSc in Quality, Safety, Security, Health and Enviromental Management)

11/2018 – 03/2019 **Academic Fellow,** Department of Civil Engineering, University of West Attica, Egaleo

Undergraduate courses:

- Strength of Materials
- Building Materials Laboratory

10/2016 – 09/2019 **Research Associate**
Collaborating researcher at Hephaestus Laboratory, Department of Petroleum and Natural Gas Technology Engineering and Mechanical Engineering, T.E.I. Eastern Macedonia and Thrace, Kavala, Greece

02/2014 – 09/2019 **Research Associate**
Collaborating researcher at the Laboratory of Strength of Materials, School of Applied Mathematics and Natural Sciences, National University of Athens, Zografou, Greece

09/2013 – 12/2015 **Research Associate**
Collaborating researcher at the Laboratory of Structural Engineering and Elements of Technical Projects, School of Agricultural Surveying Engineering, National University of Athens, Greece

09/2009 – 12/2012 **Research Assistance**
Laboratory assistant at the Technical Engineering Laboratory, Department of Engineering, Department of Civil Engineering, Democritus University of Thrace, Xanthi, Greece

11/2007 – 10/2010 **Visiting Predoctoral Fellow at the Center of Advanced Cement Based Materials**, Robert R. McCormick School of Engineering and Applied Science, Northwestern University, Chicago, USA

Today….

REASEARCH PROGRAMS

2023-2026: Multi-Material Design using 3D Printing, MADE-3D, Horizon Project 101091911

2023-25: Recycling and reuse of polymer foams in cement-based materials – COAST EPS

2023-25: Advanced nanostructured materials for sustainable growth: Green energy production/storage, energy saving and environmental remediation

….in the past

2022-24: Building Ecosystem Integration Labs at HEI to foster Smart Specialization and Innovation on Sustainable Raw Materials, HEI4S3-RM

2018-22: Nanoreinforced concrete for pavement deicing – NEA ODOS

2019-22: Utilization of marble byproducts to enhance cement based materials - MARMAROTSIMENTO

2016-18: Real time non-destructive structural health monitoring and damage assessment of concrete structures using smart self-sensing cement based hybrid nanocompo-sites – Nano cement sensor (Principal Investigator)

2014-15: Monitoring of the structural integrity of restored structural parts in ancient monuments of cultural heritage by employing hybrid materials reinforced with carbon nanotubes

2013-15: Development of innovative cement based nanocomposites with stress/strain sensing capabilities (Principal Investigator)

2013-14: Experimental and theoretical investigation of mechanical properties

degradation of the aeronautical aluminum alloy 2024 due to corrosion
2012: Center for Multifunctional Nanocomposite Construction Materials
2011: Production and mechanical characterization of nanocomposite materials
2009-11: Pericles S. Theohari Scholarship
2007-10: Crack free concrete made with nanofiber reinforcement

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SCIENTIFIC ACHIEVEMENTS

World Top 2% Scientists in 2023, 2025 (Stanford University (USA)
2016-2018: Scholarship: Eastern Macedonia and Thrace Institute of Technology fellowships for assisting young scientists in prototyping innovative products by using cutting-edge technology (Stavros Niarchos Foundation)
2013-2015: Scholarship of the Foundation of State Scholarships (I.KY.) for the preparation of post-doctoral research in Greece. Title: Development of innovative building materials with the ability to monitor their structural integrity
2009-2011: Pericles S. Theohari Scholarship
2023: Patent: "Method and device for nanobubble production", A.C. Mitropoulos, A. Varoutoglou, B. Mitridis, Z. Metaxa, Hellenic Industrial Property Organization, 1010591.
2019: Patent: "Sensors made of cement-based nanocomposite materials for continuous and non-destructive testing of the structural integrity of concrete structures in real time", by Z.S. Metaxa, S.K. Kourkoulis, E.P., Favvas, A.C. Mitropoulos, Hellenic Industrial Property Organization, 20170100137.
2016: Patent: "Highly dispersed carbon nanotube reinforced cement based materials", by S.P. Shah, M.S. Konsta-Gdoutos and Z.S. Metaxa, US Patent and Trademark Office, Patent US9499439B2.
2014: Patent: "Highly Concentrated Carbon Nanotube Suspensions for Cementitious Materials and Method of Reinforcing Such Materials", by M. C. Hersam, J.-W.T. Seo, S. P. Shah, M. S. Konsta-Gdoutos and Z. S. Metaxa, US Patent and Trademark Office, Patent US8865107 B2

MEMBER OF ORGANIZATIONS

- ✓ American Concrete Institute (ACI)
- ✓ ACI Technical Committee 236-D Material Science-Nanotechnology of Concrete
- ✓ American Nano-Society
- ✓ European Structural Integrity Society
- ✓ Technical Chamber of Greece (TEE)
- ✓ Civil Engineers Association
- ✓ Hellenic Society for Experimental Materials Engineering

PUBLICATIONS

• **Metaxa, Z.S.**, Koryfidou, S., Grigoriadis, L., Christodoulou, E., Ekmektsis, A., Mitropoulos, A.C. Waste Marble Slurry as Partial Substitution for Cement: Effect of Water-to-Cement Ratio. *Applied Sciences* 15(19), 10451 (2025). https://doi.org/10.3390/app151910451.

• Zeimpekis, V., Gialos, A., Dimou, A.E., Charalampidou, C.M., Asimakopoulos, G., Karatasios, I., Gournis, D., Karakassides, M.A., **Metaxa, Z.S.**, Kourkoulis, S.K., Alexopoulos, N.D., Sustainable lime-based nano-reinforced pastes for structural health monitoring of the restoration areas of Monuments of Cultural Heritage. *Construction and Building Materials* 480, 141456 (2025)

https://doi.org/10.1016/j.conbuildmat.2025.141456.

• Stogia, M.-E., Pasiou, E. D., **Metaxa, Z.S.**, Kourkoulis, S. K., Alexopoulos, N. D. Ternary Restoration Binders as Piezoresistive Sensors: The Effect of Superplasticizer and Graphene Nanoplatelets' Addition. *Nanomaterials* 15(7), 538 (2025). https://doi.org/10.3390/nano15070538.

• **Metaxa, Z.S.**, Kytinou, V.K., Prokopiou, V.D., Zapris, A.G., Apostolidou, E., Alexopoulos, N.D. Novel extruded polystyrene lightweight thermoinsulating cement mortar: Experimental investigation of the mechanical behaviour. *Procedia Structural Integrity* 68, pp. 184-189 (2025) https://doi.org/10.1016/j.prostr.2025.06.040.

• Kytinou, V.K., **Metaxa, Z.S.**, Zapris, A.G., Kosheleva, R.I., Prokopiou, V.D., Alexopoulos, N.D. Exploitation of extruded polystyrene (XPS) waste for lightweight, thermal insulation and rehabilitation building applications. *Developments in the Built Environment* 20, 100580 (2024). https://doi.org/10.1016/j.dibe.2024.100580.

• Pringopoulos, T.A., Thomoglou, A.K., Fantidis, J.G., Thysiadou, A.A., **Metaxa, Z.S.** Advanced Lime Mortars for Historical Architectural Structures. *Engineering Proceedings*, 70(1), 58 (2024). https://doi.org/10.3390/engproc2024070058.

• Foudas, A., Kyzas, G.Z., **Metaxa, Z.S.**, Mitropoulos, A.C. The effect of nanobubbles on Langmuir-Blodgett films. *Journal of Colloid and Interface Science* 669, pp. 327-335 (2024). https://doi.org/10.1016/j.jcis.2024.04.233.

• Maroulas, K.N., Trikkaliotis, D.G., **Metaxa, Z.S.**, AbdelAll, N., Alodhayb, A., Khouqeer, G.A., Kyzas, G.Z. Super-hydrophobic chitosan/graphene-based aerogels for oil absorption. *Journal of Molecular Liquids* 390, pp. 123071 (2023). https://doi.org/10.1016/j.molliq.2023.123071.

• Tziviloglou, E., **Metaxa, Z.S.**, Maistros, G., Kourkoulis, S.K., Karousos, D., Favvas, E.P., Alexopoulos, N.D. Electrochemical Impedance as an Assessment Tool for the Investigation of the Physical and Mechanical Properties of Graphene-Based Cementitious Nanocomposites. *Nanomaterials* 13(19), 2652 (2023). https://doi.org/10.3390/nano13192652.

• Thomoglou, A.K., Fantidis, J.G., Voutetaki, M.E., **Metaxa, Z.S.**, Chalioris, C.E. Mechanical Characterization of Nano-Reinforced Mortar: X-ray Micro-CT for 3D Imaging of Microstructure. *Engineering Proceedings* 41(1), 4 (2023). https://doi.org/10.3390/engproc2023041004.

• Prokopiou, V., **Metaxa, Z.S.** Micro-oxydation of wine in a ceramic vessel with CNT. *Materials Today: Proceedings* 93 (4), pp. 772-778 (2023). https://doi.org/10.1016/j.matpr.2023.07.003.

• Pavlopoulou, L.-Ch., Dimou, A.E., Stogia, M.-E., **Metaxa, Z.S.**, Kourkoulis, S.K., Alexopoulos, N.D. Lime-based nanocomposites for masonry restoration: Towards the implementation of small-scale restoration. *Materials Today: Proceedings* 93 (4), pp. 761-766 (2023). https://doi.org/10.1016/j.matpr.2023.06.348.

• Vasileiou, E., Pavlopoulou, L.-Ch., Dimou, A.E., Karatasios, I., **Metaxa, Z.S.**, Asimakopoulos, G. Andrikopoulos, A., Zeimpekis, V., Alexopoulos, N.D. On the economic evaluation of restoration activities of modern monuments of cultural heritage with piezoresistive nanocomposites. *Materials Today: Proceedings* 93 (4), pp. 614-617 (2023). https://doi.org/10.1016/j.matpr.2023.03.773.

• Dimou, A.E., **Metaxa, Z.S.**, Kourkoulis, S.K., Alexopoulos, N.D., Piezoresistive properties of natural hydraulic lime binary pastes with incorporated carbon-based nanomaterials under cyclic compressive loadings. *Nanomaterials* 12 (20), 3695 (2022). https://doi.org/10.3390/nano12203695.

• Patrinou, A., Tziviloglou, E., Varoutoglou, A., Favvas, E., Kyzas, G.Z., **Metaxa, Z.S.**, Cement Composites with Graphene Nanoplatelets and Recycled Milled Carbon Fibers Dispersed in Air Nanobubble Water. *Nanomaterials* 12 (16), 2786 (2022). https://doi.org/10.3390/nano12162786.

• Dimou, A.E., Asimakopoulos, G. Karatasios, I. Gournis, D., **Metaxa, Z.S.**, Kourkoulis, S.K, Alexopoulos, N.D., Self-diagnostic lime-pozzolan-cement restoration nanocomposites: Effect of graphene modification and cyclic loading level under compression. *Developments in the Built Environment* 10, pp. 100068 (2022). https://doi.org/10.1016/j.dibe.2022.100068.

• **Metaxa, Z.S.**, Boutsioukou, S., Amenta, M., Favvas, E.P., Kourkoulis, S.K., Alexopoulos, N.D., Dispersion of Multi-Walled Carbon Nanotubes into White Cement Mortars: The Effect of Concentration and Surfactants. *Nanomaterials* 12(6), pp. 1031 (2022). https://doi.org/10.3390/nano12061031.

• Dimou, A.E., **Metaxa, Z.S.**, Kourkoulis, S.K., Karatasios, I., Alexopoulos, N.D., Tailoring the binder matrix of lime-based binders for restoration interventions with regard to mechanical compatibility. *Construction and Building Materials* 315, pp. 125717 (2022). https://doi.org/10.1016/j.conbuildmat.2021.125717.

• Dimou, A.-E., **Metaxa, Z.S.**, Alexopoulos, N.D., Kourkoulis, S.K., Assessing the potential of nano-reinforced blended lime-cement pastes as self-sensing materials for restoration applications. *Materials Today: Proceedings* 62, pp. 2482-2487 (2022). https://doi.org/10.1016/j.matpr.2022.02.623.

• Amenta, M., **Metaxa, Z.S.**, Papaioannou, S., Katsiotis, M.S., Kilikoglou, V., Kourkoulis, S.K., Karatasios, I., Quantitative evaluation of self-healing capacity in cementitious materials. *Material Design and Processing Communications* 152, pp. 1-7 (2021). https://doi.org/10.1002/mdp2.152.

• **Metaxa, Z.S.**, Tolkou, A.K., Efstathiou, S., Rahdar, A., Favvas, E.P., Mitropoulos, A.C., Kyzas, G.Z., Nanomaterials in Cementitious Composites: An Update. *Molecules* 26(5), pp.1430 (2021). https://doi.org/10.3390/molecules26051430.

• Anastopoulos, S., Givannaki, F., Papanikos, P., **Metaxa, Z.S.**, Alexopoulos, N.D., Calculation of a composite material's modulus of elasticity: Comparison of results using fixed angles orientation and RVE with those using random orientation tensor and multi-step homogenization. *Procedia Structural Integrity* 28, pp. 2132-2141 (2020). https://doi.org/10.1016/j.prostr.2020.11.040.

• Dimou, A.-E., Charalampidou, C.-M., **Metaxa, Z.S.**, Kourkoulis, S.K., Karatasios, I., Asimakopoulos, G., Alexopoulos, N.D., Mechanical and electrical properties of hydraulic lime pastes reinforced with carbon nanomaterials. *Procedia Structural Integrity* 28, pp. 1694–1701 (2020). https://doi.org/10.1016/j.prostr.2020.10.144.

• **Metaxa, Z.S.**, Kourkoulis, S.K., Dispersion of graphene nanoplatelets reinforcing type II cement paste. *Procedia Structural Integrity* 13, pp. 2011-2016 (2018)**.** https://doi.org/10.1016/j.prostr.2018.12.215.

• **Metaxa, Z.S.**, Neri, W., Poulin, P., Alexopoulos, N.D., Strain monitoring of cement-based materials with embedded polyvinyl alcohol - carbon nanotube (PVA-CNT) fibers. *Frattura ed Integrità Strutturale* 40, pp. 61-73 (2017). http://dx.doi.org/10.3221/IGF-ESIS.40.06.

• **Metaxa, Z.S.**, Pasiou, E.D., Dakanali, I., Stavrakas, I., Triantis, D., Kourkoulis, S.K., Carbon nanotube reinforced mortar as a sensor to monitor the structural integrity of restored marble epistyles under shear. *Procedia Structural Integrity* 2, 2833-2840 (2016). https://doi.org/10.1016/j.prostr.2016.06.354.

• **Metaxa, Z.S.**, Exfoliated graphene nanoplatelet cement based nanocomposites as piezoresistive sensors - influence of nanoreinforcement lateral size on

monitoring capability. *Ciência & Tecnologia dos Materiais* 28, pp. 73-79 (2016). https://doi.org/10.1016/j.ctmat.2015.12.001.

• **Metaxa, Z.S.**, Polycarboxylate based superplasticizers as dispersant agents for exfoliated graphene nanoplatelets reinforcing cement based materials. *Journal of Engineering Science and Technology Review* 8, pp. 1-5 (2015).

• **Metaxa, Z.S.**, Konsta-Gdoutos, M.S., Shah, S.P., Carbon nanofiber cementitious composites: effect of debulking procedure on dispersion and reinforcing efficiency. *Cement and Concrete Composites* 36, pp. 25-32 (2013). https://doi.org/10.1016/j.cemconcomp.2012.10.009.

• **Metaxa, Z.S.**, Seo, J.-W.T., Konsta-Gdoutos, M.S., Hersam, M.C., Shah, S.P.

Highly Concentrated Carbon Nanotube Suspensions for Cementitious Materials. *Cement and Concrete Composites* 34, pp. 612-617 (2012). https://doi.org/10.1016/j.cemconcomp.2012.01.006.

• **Metaxa, Z.S.**, Konsta-Gdoutos, M.S., Shah, S.P., Carbon Nanofiber-Reinforced Cement-Based Materials. *Transportation Research Record: Journal of the Transportation Research Board* 2142, pp. 114-118 (2010). https://doi.org/10.3141/2142-17.

• Konsta-Gdoutos, M.S., **Metaxa, Z.S.**, Shah, S.P., Multi-scale Mechanical and Fracture Characteristics and Early-age Strain Capacity of High Performance Carbon Nanotube/Cement Nanocomposites. *Cement and Concrete Composites* 32, pp. 110-115 (2010). https://doi.org/10.1016/j.cemconcomp.2009.10.007.

• Konsta-Gdoutos, M.S., **Metaxa, Z.S.**, Shah, S.P., Highly Dispersed Carbon Nanotube Reinforced Cement Based Materials. *Cement and Concrete Research* 40 , pp. 1052-1059 (2010). https://doi.org/10.1016/j.cemconres.2010.02.015.