

ELSA QOKU - CV

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Current employment

05/2025 – Present **Research Group Leader “Microstructure and Modelling”**
Institute of Building Materials Research (ibac)
RWTH, Aachen, Germany

Previous employment

05/2022 – 03/2025 **Post-Doctoral Fellow**
School of Civil and Environmental Engineering
Georgia Institute of Technology (Georgia Tech)
Atlanta, USA

09/2019 – 04/2022 **Habilitation candidate**
Institute of Ceramics, Refractories and Composite Materials
Department of Building Chemistry and Building Composites
TU Bergakademie Freiberg, Germany

07/2013-09/2019 **Research associate**
Institute of Ceramics, Glass and Building Materials
Department of Building Materials
TU Bergakademie Freiberg, Germany

01/ 2013 –07/ 2013 **Lecturer of Physics**
University of Elbasan, Faculty of Natural Sciences, and Polytechnic
University of Tirana, Albania
Subjects: Thermodynamics, Atomic Physics and Theoretical Physics and
practical courses for undergraduate students

Research stays

09/2020-03/2021 **Visiting Scholar**
Group of Solid-State NMR of Inorganic Materials (Jørgen Skibsted)
Department of Chemistry, Aarhus University, Denmark

Topic Characterization of phase assemblage development employing ^{27}Al and ^{29}Si
MAS NMR spectroscopy in hydrated pure cement phases

07/2018 **Visiting Scholar**
Group of Solid-State NMR of Inorganic Materials (Jørgen Skibsted)
Department of Chemistry, Aarhus University, Denmark

Topic Investigation of phase assemblage by ^{27}Al and ^{29}Si MAS NMR spectroscopy
in hydrated ternary systems of Portland cement – calcium aluminate -sulphate

05/2012 – 09/2012 **Visiting Master Student**
Institute of Ceramics, Glass, and Construction Materials
TU Bergakademie Freiberg, Germany

Topic X-ray in-situ phase investigation of a hydrated calcium aluminate rich ternary binder. Comparison a reflection and transmission geometry.

Education

2019	Doctoral thesis (Dr.-Ing)	Institute of Ceramics, Glass, and Construction Materials TU Bergakademie Freiberg, Germany
Title	Characterization and quantification of crystalline and amorphous phase assemblage in ternary binders during hydration Magna Cum Laude	
Advisors	Prof. Dr. Ing. Thomas A Bier Prof. Dr. Dr. Habil. Herbert Pöllmann	
2010–2012	M.Sc. Physics	Faculty of Natural Sciences (Albania) & TU Bergakademie Freiberg (Germany)
2007–2010	B.Sc. Physics	Faculty of Natural Sciences, Albania

Honors, Awards & Scholarships

2021	German Chemical Society (GDCh) Förderpreis 2020 Best PhD Thesis for 2020 Division: Chemistry of Building Materials Scholarship in (DocMASE-Erasmus)-Joint European Doctoral Program in Advanced Materials Science and Engineering, Lulea University, Sweden (Declined)
07/2013	
05/2012-09/2012	DAAD-Fellowship for the experimental part of the Master thesis Institute of Ceramics, Glass and Building Materials Department of Building Materials TU Bergakademie Freiberg, Germany

Finalist of Competitive Academic Applications

- Assistant Professor Rank- University of Michigan Ann Arbor, USA (R1: Research Intensive Institutions)
- Research Group Leader at Max Planck Society – Competition for 2.6M Euro funding

Summary of Research and Related Projects

My research interests focus on understanding the hydration mechanism and microstructure development of cement-based materials. Applied analytical techniques comprise X-ray diffraction, Pair Distribution Function (PDF), thermal analysis, MAS NMR spectroscopy, Fourier Transform - Infrared (FTIR) spectroscopy, microscopy and thermodynamic modelling.

Projects

- Application of advanced X-ray synchrotron techniques to investigating the role of chemical additives in low embodied CO₂ cements (*Industry funded*) - **Ongoing**
- On the hydration of pure cement phases: A time-resolved microstructural characterization and its impact on technological properties. **Period:** 09/2019–04/2022
- Characterization of phase assemblage development employing ²⁷Al and ²⁹Si MAS NMR spectroscopy in hydrated pure cement phases. **Period:** 09/2020–03/2021
- Time-resolved microstructural characterization of calcium aluminate-based tile adhesives (*Industry funded*). **Period:** 2018 – 2019
- Investigations on the hydration of phosphate bonded cement (*Industry funded*). **Period:** 2017 – 2019

- Characterization and quantification of crystalline and amorphous phase assemblage in ternary binders during hydration (*PhD project*). **Period:** 2014 – 2019

Beamtime Awarded at Major Facilities from Competitive Proposal System

As Principal Investigator

- **Argonne National Laboratory** Dec. 2022
11-ID-B, Advanced photon source
72 hours (9 shifts) of beam time awarded
- **Argonne National Laboratory** Mar. 2023
11-ID-B, Advanced photon source
48 hours (6 shifts) of beam time awarded
- **Canadian Light Source (CLS)** May 2023
Brockhouse High Energy Wiggler Station
24 hours (3shifts) of beam time awarded

As Experimental lead

- **Advanced light source (ALS, Berkeley)** Feb. 2023
7.0.1.2, COSMIC Imaging
24 hours (3 shifts) of beam time awarded
- **Advanced light source (ALS, Berkeley)** Dec. 2023
7.0.1.2, COSMIC Imaging
48 hours (6 shifts) of beam time awarded

Teaching

- **Primary instructor for the courses:**
Analytical Methods in the Hydration of Cement-Based Materials 2021
Atomic Physics and Thermodynamics 2012-2013
- **Teaching assistant for the courses:** 2015-2022
Building Materials
Building Materials Technology
Building Chemistry
Design and Development of Chemical Bonded Materials
- **Assistant of Laboratory courses:**
Cements & Ternary systems 2014-2022
Practical courses of General Physics 2012-2013

Research Mentoring & Advising

Co-Advisor of Master/Diploma thesis at Technical University of Freiberg, Germany:

Sidorela Vishkulli: “Investigation of geopolymer binders with blast furnace slag produced in Elbasan, Albania.” Currently, Lecturer at Department of Chemistry at Tirana University, Albania

Anxhelina Qorllari: “Investigation of ternary binders through calorimetry, shrinkage and in-situ XRD”. Currently, PhD student at Technical University of Freiberg, Germany

Vasiola Zhaka: “Hydration of quaternary systems composed of Portland cement, Calcium aluminate, sulphate and slag/fly ash/limestone powder”. Currently, PhD student at Lulea University of Technology, Sweden

Paul Kloplich: “Comparison of the water vapor diffusion coefficients of cementitious building materials with different measuring methods”. Currently, Engineer for building materials in Dresden area, Germany

Liqiao Liu: “Influence of metakaolin and limestone powder on the microstructure of ternary binders”

Advising of students during summer internships visits at Technical University of Freiberg, Germany:

Momina Rauf: “Performed work on the role of different sulphate sources in the hydration of Ordinary Portland cement and Calcium aluminate cement rich ternary binders.” Currently, PhD student at University of Illinois, Urbana Champaign, USA

Waleed Ahmed: “Performed work on the evaluation of technological properties of TiO₂ and SilicaFume nanoparticles in Self-compacting Cement Pastes (SCP).” Currently, Bridge Design Engineer, Karachi, Pakistan

Supervision of graduate and undergraduate students at Georgia Tech, USA:

Erika Landayan: Currently, Structural Designer, Washington DC, USA

Pearl Dumbo, Gracen Dutton, Khairy, Fukhraj: Currently, undergraduate students at Georgia Tech, USA

Review for Academic Journals

- Cement and Concrete Research
- Construction and Building Materials
- Cement and Concrete Composites
- Advances in Cement Research
- Sustainability

Professional Memberships & Activities

- Member of German Chemical Society - Chemistry of Building Materials, Germany
- RILEM TC Member: Magnesia-Based binders in concrete
- RILEM TC Member: Calcium Sulphoaluminate Cements
- Associate Member – ACI committee Alternative Cement 242
- Steering Group member of NOWA – Network of Women in Academia, TU Freiberg

List of Publications

Monography

Qoku E., (2019) “Characterization, and quantification of crystalline and amorphous phase assemblage in ternary binders during hydration”, TU Bergakademie Freiberg.

<https://nbn-resolving.org/urn:nbn:de:bsz:105-qucosa2-350744>

Refereed Publications

1. Nguyen V. S., Qoku E., et al. Mechanochemical synthesis of hydraulically reactive calcium silicate minerals via thermal-assisted mechanical grinding, submitted to Chemical Engineering
2. Qoku E., Reuschle D., Fitzgibbons T., Wilkinson A., Kurtis K., “HEMC modifications to tricalcium silicate hydration: Changes in kinetics and nanostructure examined by time-resolved high energy X-ray scattering” Cement and Concrete Research, 195, 107915
3. Qoku E., Xu K., Li J., Monteiro P. J.M., Kurtis K. (2023), “Advances in imaging, scattering, spectroscopy, and machine learning-aided approaches for multiscale characterization of cementitious systems”, Cement and Concrete Research, Volume 174, 107335, doi.org/10.1016/j.cemconres.2023.107335

4. Çakaj O., Civici N., Schmidt G., Qoku E., (2023) “Archeometallurgical study of bronze artefacts (from iii b.c. to vi a.d.) excavated along Albanian coastline”, Journal of Scientific Culture, Vol. 9, No. 2, pp. 29-47, DOI: 10.5281/zenodo.7265753.
5. Myftarago A., Bier T., Qoku E., Aliti R. and Zogaj M., (2023) “Multi-response optimization on hydrated calcium aluminate rich ternary binders using Taguchi design of experiments and principal component analysis, Buildings, 13(10), 2494, doi.org/10.3390/buildings13102494
6. Qoku E., Bier T., Schmidt G., Skibsted J. (2022), “Impact of sulphate source on the hydration of ternary pastes of Portland cement, calcium aluminate cement and calcium sulphate”, Cement and Concrete Composites, Volume 131, 104502, doi.org/10.1016/j.cemconcomp.2022.104502
7. Tole I., Delogu F., Qoku E., Habermehl-Cwirzen K., Cwirzen A. (2022), “Enhancement of the pozzolanic activity of natural clays by mechanochemical activation”, Construction and Building Materials, Volume 352, October 2022, 128738, doi.org/10.1016/j.conbuildmat.2022.128739.
8. Qoku E., Bier T. (2021), “Charakterisierung und Quantifizierung der Phasenbildung in zementhaltigen Materialien”, ACAMONTA, Zeitschrift für Freunde und Förderer der TU Bergakademie Freiberg, pp. 66-71, <https://bit.ly/3slOgfV>
9. Duna L.L., Audray N.N., Tchamba A. B., Billong N., Kamseu E., Qoku E., Alomayri Th. S., Bier T. A.:(2021) “Engineering and mineralogical properties of Portland cement used for building and road construction in Cameroon, International Journal of Pavement Research and Technology, <https://link.springer.com/article/10.1007%2Fs42947-021-00055-9>
10. Qoku E., Scheibel M., Bier T., Gerz A. (2020), “Phase development of different magnesium phosphate cements at room temperature and elevated temperatures”, Journal of Construction and Building Materials, Volume 12, July 2017, Pages 37-50, <https://doi.org/10.1016/j.job.2017.05.005>.
11. Qoku E., Bier Th. A., Westphal T. (2017), “Phase assemblage in ettringite-forming cement pastes: An X-ray diffraction and thermal analysis characterization”, Journal of Building Engineering, 12 (1), pp. 37-50. <https://doi.org/10.1016/j.job.2017.05.005>
12. Papajani B., Qoku E., Malkaj P., Dilo T. (2015): “The study of phase compound in and degree of crystallinity of recycled LDPE by X-ray diffraction and optical microscope” International Journal of Science and Research (IJSR), 4(2), pp. 2228 –2232 https://www.ijsr.net/search_index_results_paperid.php?id=SUB151711
13. Bier T.A., Bajrami A., Westphal T., Qoku E., Qorllari A. (2015), “Influence of Re-Dispersible Powders on Very Early Shrinkage in Functional Mortars” Advanced Material Research 1129, pp. 77-85. <https://doi.org/10.4028/www.scientific.net/AMR.1129.77>
14. Vataj E., Hobdari E., Islami A., Dilo T., Civici N., Qoku E. (2014), “Preliminary investigative results of glass strips from the Paleochristian Basilica of Elbasan” Bulletin of Natural Science 15, 2014, ISSN 2305-882X.

15. Dilo T., Civici N., Stamati F., Bilani O., Çakaj O., Duka E., Qoku E., Vangjeli Sh. (2014): “Contributions to archeometallurgical studies of ancient metal objects in Albania, the present and the future”, Bulletin of Natural Science 16, ISSN 2305-882X.

Referred Conference Proceedings

1. E. Qoku, A.P. Wilkinson, and K.E. Kurtis (2023), “Time resolved synchrotron X-ray diffraction investigations of LC3 hydration in the presence of hydroxyethyl methyl cellulose ethers”. Proceedings of the 16th International Congress on the Chemistry of Cement 2023 (ICCC2023).
2. Qoku E., Bier T. A. (2022), “Influence of sulphate source on hydration and phase formation of iron rich ternary binders”, Calcium Aluminates, Proceedings of the International Conference, Cambridge, England, ISNN, pp.281-292.
3. Qoku E., Bier T. A., Bier, Schmidt G. (2018), “Characterization of phase assemblage in ettringite-forming pastes as a function of calcium aluminate cement variation”. 20th International Conference of Building Materials (IBAUSIL), Weimar pp.669-679, ISBN: 978-3-00-059950-7
5. Qorllari A., Qoku E., Bier. Th. A, Dilo. T. (2017), “Investigation of ternary binder-based systems in terms of Calorimetry, Shrinkage and In-Situ XRD” International Conference of Technology, UBT: ISBN: 978-9951-437-65-3, pp: 44-49.
6. Westphal T., Bier T. A., Qoku E., Qorllari A. (2016), “Examining large set of XRD measurements with exploratory factor analysis” 38th Conference on Cement Microscopy (ICMA), Lyon, ISBN: 1-930787-12-X, pp. 16-30.
7. Qoku E., Westphal T., Bier T. A., Dilo T. (2014), “In-situ x-ray diffraction analysis of early hydration of cementitious systems and microstructural investigation with SEM” 36th Conference on Cement Microscopy (ICMA) Milano, ISBN: 1-930787-09-X, pp.602-614.
8. Bier T. A., Markja I. and Qoku E.: (2014), “Comparison of pore structure of hardened mortars based on Portland cement and calcium aluminate cement” 36th Conference on Cement Microscopy (ICMA) Milano, ISBN: 1-930787-09-X, pp.541-551.
9. Qoku E., Westphal T., Bier T. A., Dilo T. (2014), “In-situ microstructural investigation of early hydration in a ternary binder”. Kristallographie in der Praxis, Freiburger Forschungsforum, pp. 54-59.
10. Qoku E. and Bier T. A. (2014), “In-situ X-ray investigation of the hydration process of Ordinary Portland Cement and Calcium Aluminate Cement”. International Seminar on Advanced Concrete Technology and its applications, Islamabad, Pakistan, ISBN: 978-969-8535-27-8, pp.23-28.

Non-referred conference presentations

1. Nguyen T., Qoku E., Uzal B., Wilkinson A., Kurtis K. Interactions of Calcium Sulfoaluminate Belite Cements with Alkanolamines as Admixtures, ACI Spring Convention, Toronto Canada, 2025.

2. Qoku E., L.Liu, Bier T. (2022), “Role of metakaolin and limestone substitution on the microstructure of ternary binders of Portland and calcium aluminate cement and sulphate”. 4th International Conference on the Chemistry of Construction Materials: Karlsruhe, ICCCM, Book of Abstracts, Germany.
3. Qoku E., Bier T. (2022), “Characterization and quantification of crystalline and amorphous phase assemblage in ternary binders during hydration”, First Conference of the National Institute of Physics, Albania, Book of Abstracts, pp.42-43.
4. Cakaj O., Duka E., Schmidt G., Civici N., Qoku E., Dilo T. (2019), “Preliminary study of Anastasius Emperor’s coins (vi ad) excavated in the Macellum build in his honour, in Durrës, Albania”, 5th International Conference of Archaeometallurgy in Europe, Hungary.
5. Duka E., Cakaj O. Dilo T., Qoku E., Bunguria A. (2019), “In search of Ilyrian metallurgy: Case Study of iron Slag founded in Lura”. 1st Conference of Applied Physics, Albania, Book of Abstracts.
6. Cakaj O., Dilo T., Civici N., Qoku E., Schmidt G., Duka E. (2017), “Archeometallurgical study of medieval nails excavated in Durrës”. International Conference on Applied Science and Engineering, Albania, Book of Abstracts

Posters

1. Qoku E., Wilkinson A., Kurtis K., (2022), “The role of HEMC in the hydration of LC3 blends. First insights from calorimetry and In-Situ X-ray synchrotron diffraction”. International Conference of the Chemistry of Construction Materials: Karlsruhe, Germany.
2. Qoku E., Aliti R., Bier T. A, Ziberi B. (2018), “Calcium sulphoaluminate cement vs. calcium aluminate cement-sulphate based binder. Comparison of the hydration kinetics and phase assemblage.” International Workshop on Calcium Sulphoaluminate cements, Murten, Switzerland.
3. Qoku E. and Bier T. A. (2017), “Influence of water/solid ratio on phase formation of ettringite - rich ternary binders.” Tagung Bauchemie, Weimar, pp.84-90.
4. Qoku, E., and Bier, T. A. (2015), “Calorimetry and XRD investigation of the influence of internal standards on the hydration kinetics of cement pastes.” 19th International Conference on Building Materials (IBAUSIL), Weimar, pp.479-487.

Books & Chapters

1. Bier T., Kranzlein E., Qoku E., and Waida S. „*Supplementary cementitious materials (SCM) in OPC and alkali activated binders*” Industrial wastes – Characterization, Modification and Application of industrial residues. **Editor:** Herbert Pöllmann, **ISBN:** 9783110674866, **Publisher:** De Gruyter, <https://doi.org/10.1515/9783110674941>