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Synthesis of multiscale computational methods and experimental data for simulating cementitious materials

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Cementitious materials such as concrete are materials whose properties in the fresh and hardened state are governed by chemical and physical properties and processes that range over multiple length scales (µm – cm) and additionally change with time again over multiple scales (ranging from few seconds to several years). Thus, a multiscale modeling strategy is essential to make predictive simulations of related material properties. However, multiscale models are often plagued by the curse of dimension on the one hand and the lack of multiscale experimental data for validation on the other hand. In order to improve the quality, the feasibility and usefulness of multiscale modeling of cementitious materials reduced order strategies, and strong integration of experimental knowledge even in the model development phase is essential. Recently, there has been increased activity in the scientific community for developing data-driven methods that tightly integrate experimental data and computational mechanics. This minisymposium will focus on recent advances, challenges, and ongoing research in the multiscale computational modeling of cementitious materials with a strong focus on model validation, experimental data-driven strategies, and reduced-order methods. Among others, the following topics will be covered by the minisymposium:

- Multiscale and multilevel models for the characterization of cementitious materials and composites (continuum micromechanics, computational multiscale models)
- Reduced-order modeling strategies
- Data-driven methods for concrete characterization
- Novel discretization methods (cohesive zone models, phase-field models, gradient (non-local) damage models, peridynamics, SPH, etc.) applied to concrete modeling
- Modeling of transport and physico-chemo-mechanical processes (creep, shrinkage, chemical dissolution, chemically expansive processes)
- Rheological modeling and classification of fresh cementitious composites and concretes
- Simulation of additive manufacturing processes