

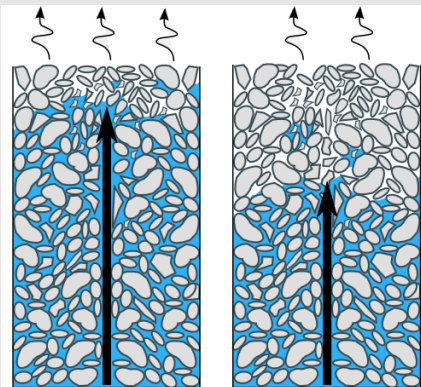
Project thesis Master thesis

Experimental and Numerical Investigation of Heat and Mass Transfer in Porous Media Systems

Supervisor: Dr.-Ing. Alfredo Nunez
Starting time: May 2026
Topics: Porous Media, Heat and Mass Transfer, Experimental Methods, CFD



Gas emissions and pollutant transport through soil in landfill environments (Press photo).



Transport phenomena in porous media
(Source: Transp Porous Med, 2015; 110:251–280).

Porous media systems are widely encountered in environmental applications, where the interaction between gas flow and heat transfer leads to complex thermo-fluid behavior. In landfill-like environments, gas transport, oxygen diffusion, and internal heat generation can produce localized temperature gradients and preferential flow paths (Liu et al., 2026). These conditions are particularly relevant, where gas accumulation and heat generation within porous waste can lead to smoldering processes and increase the risk of underground fires.

To investigate these phenomena, a lab-scale porous media system will be developed with controlled gas injection and heating. Temperature evolution and gas transport within the structure will be analyzed experimentally. In parallel, a numerical model will be implemented to study the coupled heat and mass transfer processes. Computational Fluid Dynamics (CFD) will provide detailed spatial and temporal information and supporting analysis under conditions that are difficult to access experimentally (Shen et al., 2020).

The study will focus on comparing experimental data with numerical predictions to identify key parameters governing thermal and transport behavior in porous systems.

Interested students should bring strong motivation for independent research and experimental work. Basic knowledge of Computational Fluid Dynamics (CFD) is advantageous but not mandatory.

Contact Details:

Dr.-Ing. Alfredo Nunez
Office: B.2.07
email: alfredo.nunez@fau.de