中国科学院武汉岩土力学研究所
Institute of Rock and Soil Mechanics,Chinese Academy of Sciences

岩土力学与工程前沿讲坛

Forum on Geomechanics and Geo-engineering

No.SKL*2025-05*

应岩土力学与工程安全全国重点实验室邀请，德国地球科学研究中心（GFZ）王磊研究员来访交流并做学术报告，报告信息如下：

报告人 Lecturer	**王　磊 研究员**
报告题目 Theme	**Premonitory Slip, Rupture Propagation and Frictional Sliding on Laboratory Rock Faults/Fractures: Effects of Loading Rate and Confining Pressure**
报告时间 Time	**2025 年 3 月 27 日（周四）上午 9:00**
报告地点 Spot	**武汉岩土所研发大楼 11 楼学术交流室**

欢迎广大科研人员及研究生参加！

岩土力学与工程安全全国重点实验室
State Key Laboratory of Geomechanics and Geotechnical Engineering Safety

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报告简介

Brief

Premonitory slip and migrating foreshocks transitioning into an accelerating unstable rupture are commonly observed in experiments and less frequently in nature, but what controls their spatiotemporal evolution remains unclear. In this context, we conduct a series of displacement-driven triaxial compression experiments on porous sandstone samples containing a saw-cut fault under conditions of varying load point velocities (1 to 10 μm/s), confining pressures (35 to 75 MPa) and constant pore pressure (5 MPa). Integrating far-field mechanical and displacement measurements, near-fault strain gauge arrays, and a dense network of piezoelectric transducers, we find that local premonitory slip always occurs above a threshold stress, showing a crack-like propagating front with a slow speed up to 2 cm/s. Premonitory slip is accompanied by migrating small-magnitude precursory Acoustic Emissions (AEs) with dominantly shear-enhanced compaction source mechanisms transitioning to double-couple when approaching slip events. A transition from local premonitory slip to system-size slip event corresponds to the moment at which the premonitory slip front crosses the entire fault, followed by the emergence of system-size slip event with an accelerating rupture front in the opposite direction. Premonitory slip and precursory AEs display progressively accelerating processes, culminating in slow (< 5 μm/s slip rates) or fast (1 to 10 mm/s) slip events. With increasing load point velocities, average premonitory slip rates increase at reduced precursory time spans, leading to fast slip events. Increasing confining pressure causes increasing premonitory slip and off-fault precursory AEs, but has no much effect on premonitory slip rates. Precursory slip scales with co-seismic slip, and precursory slip process is predominately aseismic. Our results imply that local variations in loading conditions at slow slip and rupture velocities will affect spatiotemporal evolution of premonitory slip and associated foreshock activity.