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KWS-X: A Powerfull SAXS/WAXS/USAXS Beamline at JCNS-MLZ

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The customized SAXS/WAXS instrument began user operations in April 2023. As the latest addition to our small-angle scattering instrument family, which uses X-rays as the primary probe, the new instrument is equipped with a high-flux Metal-Jet source and a movable Eiger2R 4M SAXS detector. It also features a 4-axis motorized WAXS detector and a Bonse-Hart USAXS system, enabling a broad scattering vector q range from 0.0002 to 7 $\text{\AA}^{-1}$. This corresponds to the capability to investigate structures spanning length scales from a few angstroms to micrometers.

Compared to other instruments, it is further enhanced by a spacious sample environment station that operates under ambient pressure conditions. This versatile sample stage supports various in situ platforms commonly used in SANS experiments, such as rheometers, electromagnets, stopped-flow devices, FT-IR spectrometers, and electrochemical workstations. The extensive array of sample environment accessories allows experiments to be conducted over a temperature range of -150°C to 1000°C, under diverse conditions including shear, humidity, tensile deformation, as well as coupled techniques such as SEC-SAXS and Raman-SAXS.

The instrument's design, combined with its wide selection of sample environments, makes it a powerful tool for investigating nanostructures—including size, shape, formation mechanisms, and particle-particle interactions in solution. It will greatly assist users of our neutron scattering facilities (such as SANS and reflectometers) in acquiring complementary X-ray structural information and will streamline the selection of suitable samples for neutron instruments, thereby improving the efficiency of our neutron scattering user programs, particularly SANS.

Since its opening in 2023, KWS-X has provided more than 8,000 hours of beam time to over 80 users and supported more than 120 proposals. Within a short period, it has already contributed to over 36 high-quality publications in renowned journals including Nature Nanotechnology, Nature Communications, Advanced Materials, JACS, Matter, and Angewandte Chemie.

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