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LAMINO-II at the IMAGE Beamline of the KIT Light Source: A New Instrument for Systematic In Situ and Operando Studies and Hierarchical Imaging for Materials and Life Sciences

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With LAMINO-II and UFO-II, two new experimental stations have recently become available at the superconducting wiggler beamline IMAGE at the KIT Light Source, dedicated for 2D/3D/4D full-field hard X-ray imaging for materials and life sciences. UFO-II focusses on serial micro-tomography, namely systematic high-throughput 3D imaging of large sample series with minimum user interaction. LAMINO-II significantly advances the opportunities of synchrotron radiation computed laminography (CL), in particular for systematic 4D in situ and operando studies as well as for hierarchical imaging. Here CL has unique capabilities for high-resolution 3D imaging of flat samples exceeding the field of view, therefore avoiding any sample dissection [1, 2].

The dedicated, 8-ton LAMINO-II allows a tilted (20°-45°) rotation of flat samples up to 250x250x40mm³ in size and 4kg of maximum weight with <1 µm error motion, which represents a considerable engineering challenge. It facilitates up to 80cm wave field propagation to a bank of two selectable detectors and it can be equipped with further imaging optics. In addition, a cable drag is available, altogether enabling LAMINO-II to handle large samples or sample environments like dedicated mechanical tensile/compression testing devices for systematic 3D in situ imaging with micrometer resolution. Here the 3D access to flat and laterally extended sample geometries allows unique *in situ* studies of highly application-relevant stress states, e.g., with low stress triaxiality or load path changes [3, 4]. By enabling large lateral sample scanning (75x75 mm²), LAMINO-II allows 3D screening of large regions as well as hierarchical 3D imaging by zooming in on selected regions of interest guided by on-the-fly data processing [5].

We report main instrumental features of the new LAMINO-II station and illustrate its methodical capabilities by first experimental results, particularly (1) of unprecedented screening and hierarchical imaging of compression fossils within the context of several centimeter-sized specimens, and (2) of 3D in situ damage analysis of plate-like devices, altogether demonstrating the unique application potential from in situ testing, via operando failure analysis up to paleontology.

Figure caption
a) Scheme of the new LAMINO-II station; b) In situ laminography for materials testing [3], c) Hierarchical 3D laminography of a compression fossil.

References

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[3] Kong *et al.*, *Acta Mater.* **231**, 117842 (2022).
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I plan to submit also conference proceedings

No

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