Product Sheet XRD 29

Universal Motion Concept and Eulerian Cradles
for Controlled Sample Positioning

Beyond classical phase identification, X-ray diffraction enables you to investigate material and structural parameters. In cases where these parameters show orientation dependence, or the shapes of the objects under investigation are more complex than common powder samples, special sample handling is required.

Any D8 diffraction system can be equipped with a variety of sample stages designed to accommodate numerous analytical requirements and in a number of cases, sample stages can even be equipped with dedicated sample holders.

Comprehensive investigations of residual stress and texture – as well as measurements of thin films, wafers or micro-structures – require the sample rotation (phi) and tilt (chi). Many applications require XY- and Z-translation for precise sample alignment or mapping of the structural sample parameters. The additional motorized axes provided by the Universal Motion Concept (UMC) sample stages and the Eulerian cradles convert a simple 2-axis diffractometer into a materials research instrument with up to 7 degrees freedom to handle virtually any sample.

The ¼-circle and the centric Eulerian cradles can be used for texture, residual stress and all manner of thin file investigations, including high-resolution X-ray diffraction (HRXRD), X-ray reflectometry (XRR), and in-plane grazing incidence diffraction (GID), provided that the instrument's optical beam path enables these applications.

Fig. 1: Centric Eulerian cradle mounted to horizontal D8 DISCOVER with VÅNTEC-500 area detector

The UMC series of stages enable to perform all of the applications of which the Eulerian cradles are capable but on larger, heavier or irregularly-shaped samples. The UMC stages are particularly advantageous for residual stress and texture investigations on bulky samples or XRR or HRXRD mapping of large samples such as wafers or glass lenses. Mounted to a vertical Theta/Theta goniometer, samples remain horizontal when running experiments with a UMC stage.

Optional dedicated sample holders that fit most of the Eulerian cradles or the UMC stages include: vacuum chucks, wafer chucks, knife edge collimators, a zeta/xi tilt stage and dome heating stages.
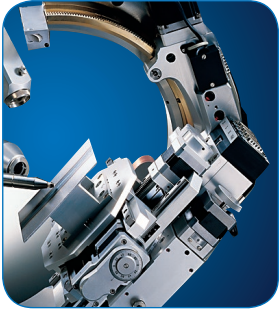
Fig. 2. ¼-circle Eulerian cradle for residual stress investigations

Fig. 3. UMC 150 stage for residual stress analysis

UMC Stages & Eulerian cradles

Name	Centric cradle	¼-circle cradle	UMC 150	UMC 150 HTS	UMC 151	UMC 350	UMC 1516
Order number	A19D3/A19D6	C79298A3244D46	A19D140	A19D160	A19D150	A19D120	A19D130
Goniometer geometry	horizontal or vertical	horizontal	vertical T/T	vertical T/T	vertical T/T	vertical T/T	vertical T/T
chi [°]	-11 … +98	- 5 … 95	-	-	-	± 10	-5 … +55
phi [°]	unlimited	unlimited	-	-	unlimited	-	unlimited
x [mm]	± 40	± 75	± 75	± 50	± 50	± 150	± 50
y [mm]	± 40	± 75	± 75	+ 150	± 50	+ 150	± 50
z [mm]	2	-1 … +12	50	50	50	50	50
Mounting sequence	chi-z-phi-x-y	chi-phi-z-x-y	z-x-y	z-x-y	z-phi-x-y	chi-z-y-x	chi-z-phi-x-y
Sample load [kg]	1	3	5.0	1.0	5.0	5.0	5.0
Sample height [mm]	40	40	133	133	113	90	90
Weight [kg]	15	25	40	43	43	57	64

Dedicated sample holders

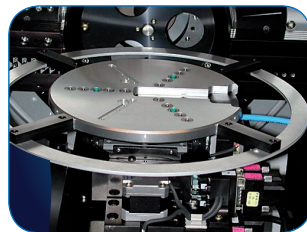Fig. 4. 3" or 5" vacuum chuck

Fig. 5. Wafer chuck
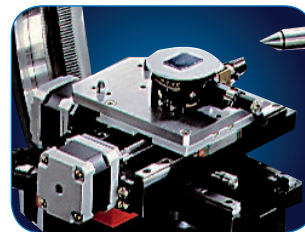
Fig. 6. zeta/xi tilt stage

Fig. 7. Capillary spinner for Eulerian cradle