Inverted Metallurgical Microscope with Image Analysis System

Part I: Inverted Metallurgical Microscope (Imported Assembled)
Model: SuXma-Met IB- I

Inverted microscope equipped with **UIS System, Infinity Plan optics** for industrial and research applications having magnification range **100X to 1000X (Dry)**. Wide magnification range, high resolution optics, polarizer and analyzer facility, large working stage with high travel range makes it perfect tool for various industrial and material science research applications.

Specification
Optics

Eyepiece Pairs - Wide field 10X, F. N. 22

Objectives - Infinity plan achromatic objectives
- PL L10X/0.25 working distance : 20.2 mm
PL L20X/0.40 working distance : 8.80 mm
PL L50X/0.70 working distance : 3.68 mm
PL L100X/0.85 (dry) working distance : 0.40 mm

Nosepiece
Objectives mounted on Quintuple, Backward ball bearing inner locating nosepiece with positive click stops. Durable, wide rubber grip on turret makes switching objectives fast and easy.

Illumination
- Koehler 6 volt / 30 watt halogen illumination, lamp housing with centering facility.
- Full range intensity variation with conveniently placed knob.
- Frosted Glass, Blue, green, and yellow filters included
Integrated field diaphragm , aperture diaphragm
puller type polarizer

Head
Binocular head is inclined 45° for easy use, with an interpupillary distance adjustment range of 53 to 75mm

Photography Port
C Mount port to adapt camera

Focusing system
Coaxial coarse/fine focus, with tension adjustable and up stop minimum division of fine focusing is 2μm.

Stage
Mechanical stage overall size: 242mmX200mm
Moving range : 30mmX30mm
Rotundity and rotatable stage size: maximal measurement is Φ130mm and minimal clear aperture is less than Φ12mm

Part II: Microstructure Image Analyzing System
Model: DeXel-Metallography I

A. Hardware

A.1 Digital Color Camera (5 Mpixel)
Make – German

Sr. No.	Description	Technical Specification
1	Image Sensor	**2/3"** type CMOS
2	Interface	USB 3.0 interface
3	Effective picture elements	2592 x 1944 (H x V)
4	Maximum Frame Rate	5.8 at high resolution
5	Pixel Size	3.4 X 3.4
6	Shutter Type	Global reset
7	Scanning Type	Progressive scan

A.2 Camera adapter

Specially designed Camera adapter as per microscope photography port

B. Software

B.1 Grain size analysis

Measurement by 2 methods

c. Intercept Method (Manual / Automatic mode) as per E 112, E 930, E1382
Facility to select number and orientation of linear test lines
Facility to select concentric test circles
Facility to select minimum number of intercept lines depending upon number of intercepts found
Facility to find intercept length and ASTM Grain No. for individual grains

d. Planemetric Method
Facility for selection of region of interest for planimetric method Color coding of grains as per ASTM size number
Grain size distribution with graphical plot and identification of largest grain available

- **Auto grain boundary tracing, enhancing and grain cleaning feature for automatic analysis**

- Pop-up alert for insufficient intercepts or grains in test region

B.2 Phase Analysis as per ASTM E562

Automatic thresholding of the image
12 No. of phases can be determined simultaneously
Pick & place of gray value for smart selection of a phase of interest from rest of the matrix Histogram, Color coding for independent phases
Facility for selection of region of interest

Manual Grid for measurement of multiple phases.

B.3 Inclusion Analysis as per ASTM E45, E1122, DIN 50602, JIS G 0555

Separation and rating as per ASTM E45, E1122, DIN 50602, JIS G 0555
Separation of superimposed inclusions (Sulphides superimposed over oxides) and rating them independently
Facility for edit and rectify manually
Provision to compile results for number of fields of view as per various standards

B.3A Inclusion analysis of as per ASTM Standard B796-02

Nonmetallic Inclusion Content of Powders Intended for Powder Forging (PF) Applications

B.4 Cast Iron Analysis

a. Nodular Cast Iron as per ASTM E 2567-11(latest standard for Image Analyzer)
Nodularity and nodule count as per As per ASTM E 2567-11
Size classification as per standard ASTM A 247 and estimation of percentage of each class
Size threshold facility to filtrate non-graphite particles
Phase analysis with facility to omit or consider graphite nodules

b. Gray Cast Iron by ASTM A247
Class separation (A, B, C & D type) of flakes as per ASTM A 247 and estimation of percentage of each class
Size classification as per ASTM A247
Identification of largest flake in the field of view and reporting the respective size class

B.5 Aluminum and alloys Analysis

Percentage porosity estimation
Geometrical parameters such as length, diameter, perimeter estimation of Silicon cuboid particles
Dendritic Arm Spacing estimation

B.6 Banding Analysis as per ASTM E1268

Anisotropy Index and Degree of Orientation estimation
Thickness of banding and inter-band spacing measurement

B.7 Decarburization depth Analysis

Facility for tracing decarb interface and selection of number of readings for better averaging

B.8 2D analysis of features of interest as per following

Object counting
Distance between any two points
Angle between any two edges
Area Measurement
Circle – radius, perimeter, circularity percentage
measurement Rectangle measurement
Irregular shape measurement

B.9 Additional features

All the results can be reported in units like micron, mm, cm, inch etc.
Quick Calibration attachment system with freedom for adding additional magnifications Special software for Database compilation and comparison

B.10 Planar Stitching in X and Y direction

One can stitch multiple images captured randomly in X and Y directions to offer complete presentation of interested area in single frame

B.11 Z stacking / Extended depth of focus

Obtaining Fully focused image by smart image blending of partially focused images captured at different Z planes.

B.12 Batch Run

Swift Batch Run (processing batch of images in one go) for effective and faster processing of large number of images captured.
This module can be effectively used in Grain Size Analysis, Phase Analysis, Inclusion Analysis, Nodularity and graphite Flake Analysis.
Analyzing parameter can be navigated image by image in case user want to fine tune them for any particular image.

B.13 Motorized Stage operating and programming software
XYZ movement control of stage from PC

B.14 Report generation in MS-Excel format

B.15 Calibration – Traceable to NPL, Delhi/CMTI Bangalore

B.16 Desktop Computer
Processor - Intel® Core™ i5, Memory - 4 GB, Hard-drive – 1 TB, Graphic card, 18.5" LED Screen, keyboard, mouse, Deskjet Printer, UPS 0.5KVA

OR

Equivalent

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