

Specifications for Optical Profilometry System

Specifications:

1. Profilometer must be capable of performing non-contact surface measurements on specimens with wide variability in surface relief and optical reflectivity.
2. Profilometer must be capable of rendering surface topographical information superimposed on a true color optical image of the surface under study
3. Profilometer must be capable of obtaining surface profile measurements, without loss of signal, on surfaces with local features whose angle to the measurement objective exceed 80 degrees.
4. Profilometer must be capable of sampling surface features over an area 4.1 mm x 3.3 mm in a single sequence of measurement, to obtain > 100,000 profile data points in the region of study in under 60 seconds.
5. Profilometer must be capable of a obtaining surface topographical information on surface features up to 7 mm in height.
6. Profilometer must be capable of accommodating specimens of interest with a maximum height of 70mm, weighing up to 5kg, on a motorized specimen stage with automated XY motion control.
7. Profilometer must be capable of performing surface topographical investigations on specimens with a region of interest up to 126mm x 76mm, and assemble the data into unified 3D specimen reconstructions that contain both topographical and true color photographic information.
8. Profilometer illumination source must employ white light.
9. Profilometer must be able to accommodate up to six different magnification objectives.
10. Profilometer analysis software must support corrosion, fracture and :
 - a. Analysis of profile roughness and contour parameters in accordance with ISO 4287 (profile parameters Pa, Pq, Pp, Pz, Pv, Pc, PSm, Psk, Pku, Pdk; waviness parameters Wa, Wq, Wz, Wp, Wv, Wc, WSm, Wsk, Wku, Wdk), ISO 4288 (roughness parameters Ra, Rq, Rz, Rp, Rv, Rc, RSm, Rsk, Rku, Rdk), ISO 5436, and ISO 11562. Calculation of roughness profiles of variable width. To include analytical routines for bearing ratio curve, statistical analysis of roughness parameters, and Fourier spectrum of profiles.
 - b. Area analysis to include computation of Sa, Sq, Sz, Sp, Sv. Analytical methods to calculate fractal dimension of the surface topographical information, and calculation of bearing ration and bearing area curves.
 - c. Volumetric analysis of surface topographical information, employing multiple volumetric bounding algorithms to include:
 - i. bounding the analytical area simple geometric shapes and more complex multiple-point selections,
 - ii. adjustment of the analytical reference surface plane
 - iii. defining the bounded volume by top cover, bottom cover, minimum spanning surface, and planar slices through the bounded 3D reconstruction points.

- d. 2-D image analysis employing the true color photographic information to include:
 - i. Dimensioning features using lines, arcs, circles, ellipses, and polylines
 - ii. Automatic measurement of lines, parallel lines, circles, and arcs
 - iii. Nominal statistical calculation of features using mean, median, standard deviation, minimum and maximum
 - iv. Searching image patterns for equally shaped structures contained a single image
- e. Creation of single and stereo image pairs for visualization
- f. Automated analysis sequences for corrosion damage analyses