

Optical Detection of Defects on Porous Surfaces

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An inspection of mechanically damaged areas on manufactured parts is necessary to produce high-quality products. A scanning probe on the object is necessary for a conventional surface inspection system, which is time-consuming. We have been studying optical surface defect detection with large field of view and high speed. Especially, we used porous surfaces such as a carbon blade as an inspection object. The carbon blade is used in the rotary pump. However, it is difficult to detect defects on porous surfaces using optical method due to roughness of the surfaces.

As an early stage, we have succeeded in defect enhancement of metal surfaces (Fig. 1) as in Fig. 2, with large field of view by using an optical spatial frequency filter and the oblique incidence of the laser beam in this experiment (Fig. 3). Optical coherent technique is required on account of high speed processing. However, scattering by the micro roughness of the metal surface has hidden the information about defects. We used oblique incident laser beam to defect detection, which enhanced specular reflection and was able to perform the spatial frequency filtering.

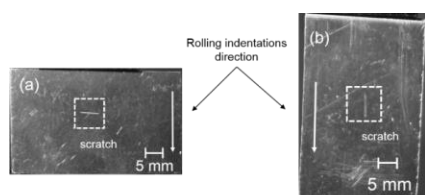


Fig. 1 Metal plates.

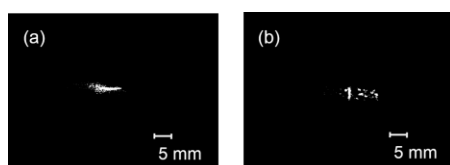


Fig. 2 Enhanced defects on metal plates.

Porous defects as shown in Fig. 4 cannot be found without applying ethanol. Figure 5 shows that the ethanol penetrated faster in the defective part. We have been trying various unusual optical approaches to detect defects on rough surfaces.



Fig. 4 Carbon blade surface.

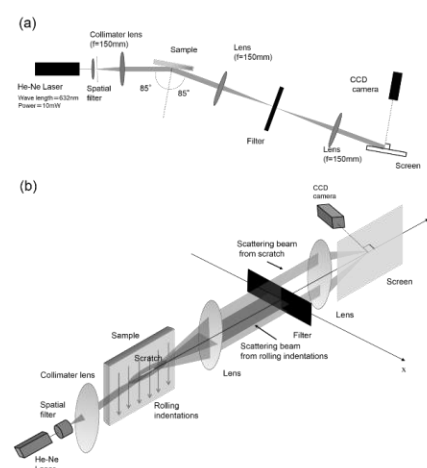


Fig. 3 Experimental setup.

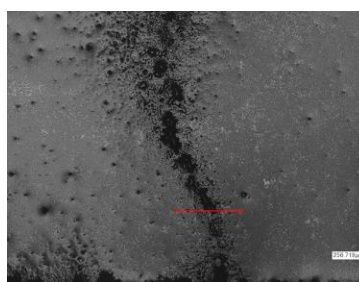


Fig. 5 Carbon blade surface applying ethanol.