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Line-focus beam photoacoustic imaging of surface and undersurface defect simulated on a planar specimen

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A theoretical formulation of photoacoustic (PA) imaging with a line-focus beam (LFB) for surface and undersurface simulated defect was performed. Equivalence between 2D surface defect photoacoustic tomography (PAT) and X-ray CT was derived. PAT imaging experiment was carried out A second harmonics of a LD-pumped YAG laser was used as a LFB. The laser power was 45mW. The length and width of a laser beam on a specimen was 25 mm times 0.65mm The measured area was 27mm x 27mm, while the reconstructed area was 18mm x 18mm. 64 times 64 resolution image was reconstructed from the rotation and translation scanning. Reconstructed PA image agreed with the PA image obtained with a point-focus PA imaging. The frequency dependence of thermally diffused image agreed well with the theoretical prediction (thermal diffusion length is inversely proportional to the square root of modulation frequency) Under surface PAT image was obtained by a thermal wave diffraction formula, and the simulated image agreed well with the experimental data.