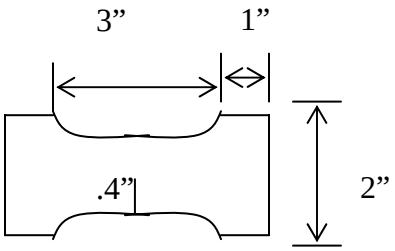
ME557 Lab experiment #3

Introduction

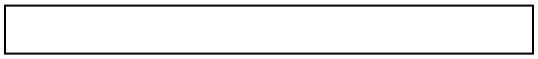
The experiment is to use moiré interferometry technique to generate a stress-strain curve from the tensile test of a dog bone specimen. The dog bone specimen is made of 76075-T7351 aluminum.

Sample Preparation:

Dog bone specimen of 7075-T7351 aluminum with a sharp notch:

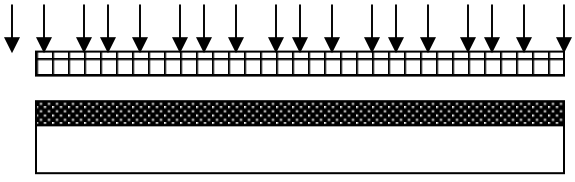


Grating replication procedure

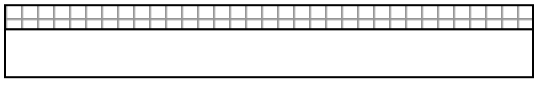


Polish from 9 to ¼ microns to mirror quality

Spin coat AZ1400 series photoresist (1 to 5μm)



Expose grating pattern 40lines/mm using UV light



After developing, cross grating pattern
Formed on the +PR

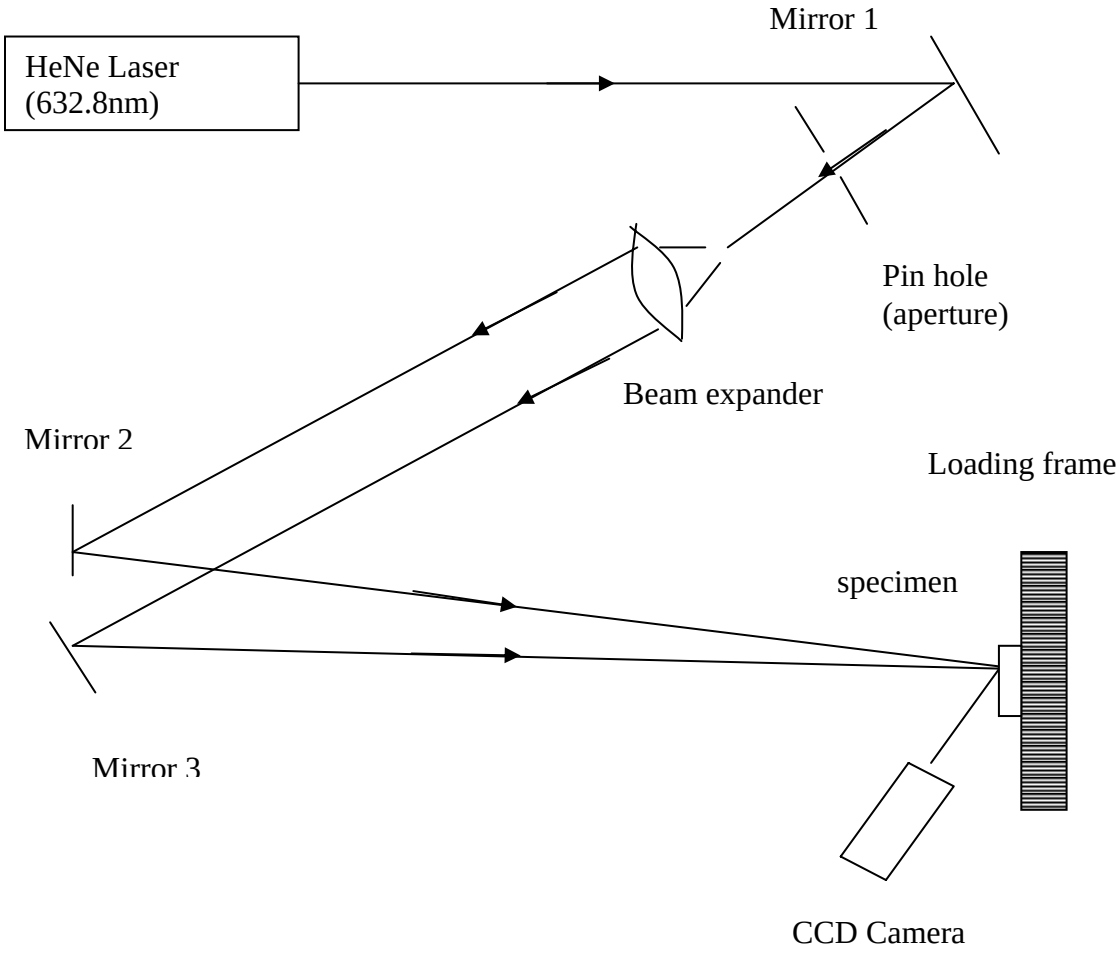
Moire Interferometery Analysis

At research in fracture mechanics evolved beyond linear elasticity with crack tip being subjected to substantial plasticity, real structural materials had to because in place of photoelastic material in order to model their frwcture responses, where moiré interferometry technique came into use.

In essence, Moiré interferometry is an optical technique where the two interfering beams create a pattern of interference fringes, which interacts with the reflected beam from a grating replicated on the specimen's surface. As the specimen grating deforms with the surface, a fringe pattern is formed due to interference between the reflected beam from the gratings and the pattern of parallel interference fringes in space.

After the onset of fatigue crack initiation, the fatigue specimen was placed in a moiré inteferometry bench and the in-situ notch tip displacement filed was determined. The specimens are loaded by screw driven, 100,000lbs capacity MTS load frame to the desired load which in this case is 100, 200, and 400 lbs. The load cell reading was read by a Fluke 11, handheld multimeters, which was connected to a manually balanced Vishay Model 2150 strain gage conditioner. A CCD camera was used to capture the moiré image of the specimens.

Moiré Interferometry Setup



Things to turn in:

1. Moire interference pattern at load = 100lbs
2. Generate a stress-strain curve based on the observed moiré interference pattern (take at every 100lbs until the sample breaks)
3. Generates the displacement field (y) as a function of distance (x) behind the notch at 400lbs (take data every 0.2”).