Pad Deformation Tests on CETR Tester

We tested six polishing pad samples, as the lower specimens on the stationary platen, for compression with a 50-mm (2") steel disc and a 10-mm steel ball, as the upper specimens on the vertically-moving carriage. In tests with the disc, the compression force Fz was gradually increased from 5N up to 50N (Fig. 1), which corresponds to the contact pressure increase from 0.37 to 3.7 psi. After reaching its maximum, the compression force was gradually reduced back to 5N. Pad deformation versus applied force was recorded during both loading and unloading. In tests with the ball, it was indented into the pad by 0.1 to 0.2 mm (depending on pad hardness). The indentation force Fz and the pad deformation were recorded during loading and unloading (see Fig. 1).

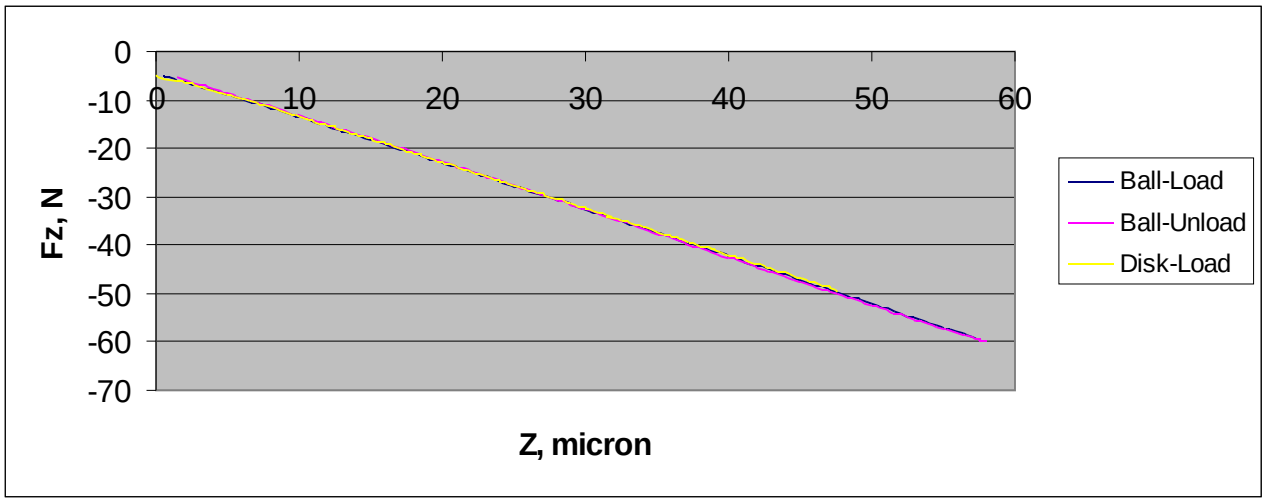


Fig. 1. Linear Loading and Unloading Curves for the CETR Tester

The test data, summarized in Fig. 2, showed significant difference between the pad samples, as well as between the tests with the disc and with the ball.

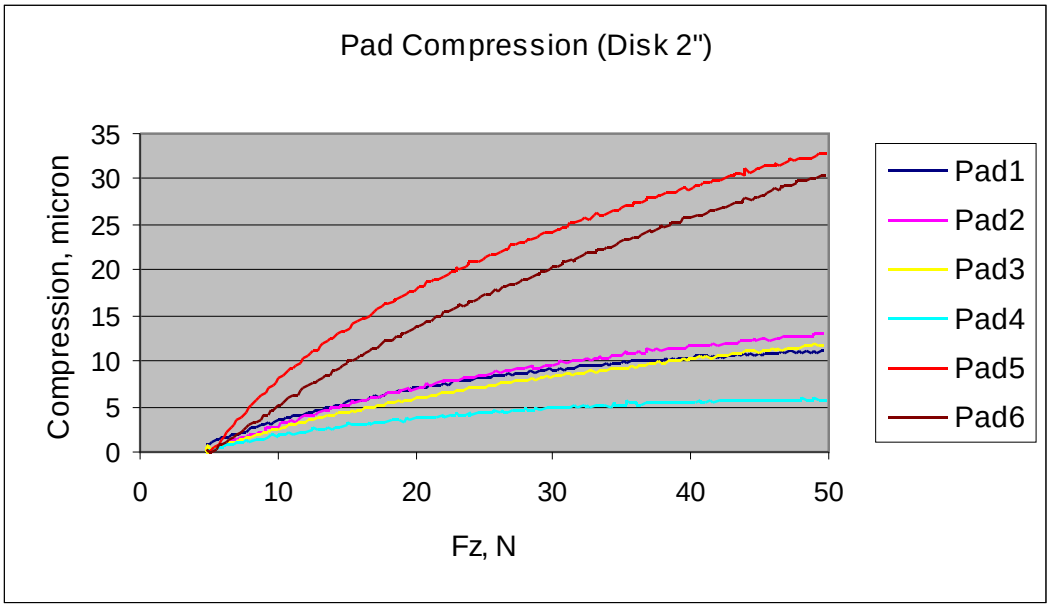
In the tests with the disc (Fig. 3), when the contact area was relatively large, the hardest pad 4 showed the smallest deformation of 6 microns.Three samples 1, 2, and 3 had similar elastic characteristics, with maximum deformation of 11 to 13 microns, while much softer pads 5 and 6 had larger deformations of 33 and 31 microns, correspondingly.

In the tests with ball indentation (Fig. 4), when the contact area was relatively small, the hardest pads 1 and 4 had a 50-micron indentation depth at 33 and 28 N, correspondingly. Softer pads 2 and 3 had a 50-micron depth at 15 N and 11 N, correspondingly. The softest pads 5 and 6 both reached 100 microns at 8 N.

When the load was reduced, the pad deformation had significant hysteresis, that is, the unloading portions of all the graphs (Fig. 3 and 4) do not coincide with the loading portions.

After the force was dropped back to 5 N, all pads had residual deformations, that characterize plastic properties of the pads. These plastic deformations were the smallest for the hardest pad 4 (2 microns), the largest for the softest pads 5 and 6 (13 microns).

In the disc test data, one can also observe pad creep at the constant load of 50 N (see Fig. 3), which was almost negligible (less than 1 micron) for the hardest pads 1 and 4, but reached 2 to 4 microns for the softer pads.



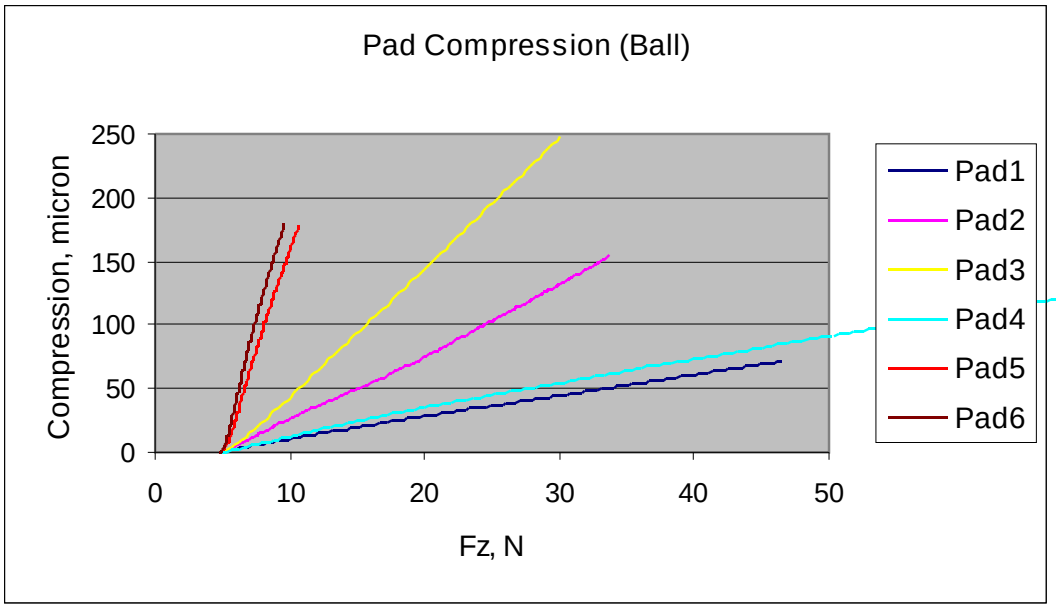


Fig. 2. Summary of Compression Test Data for Disc and Ball Tests

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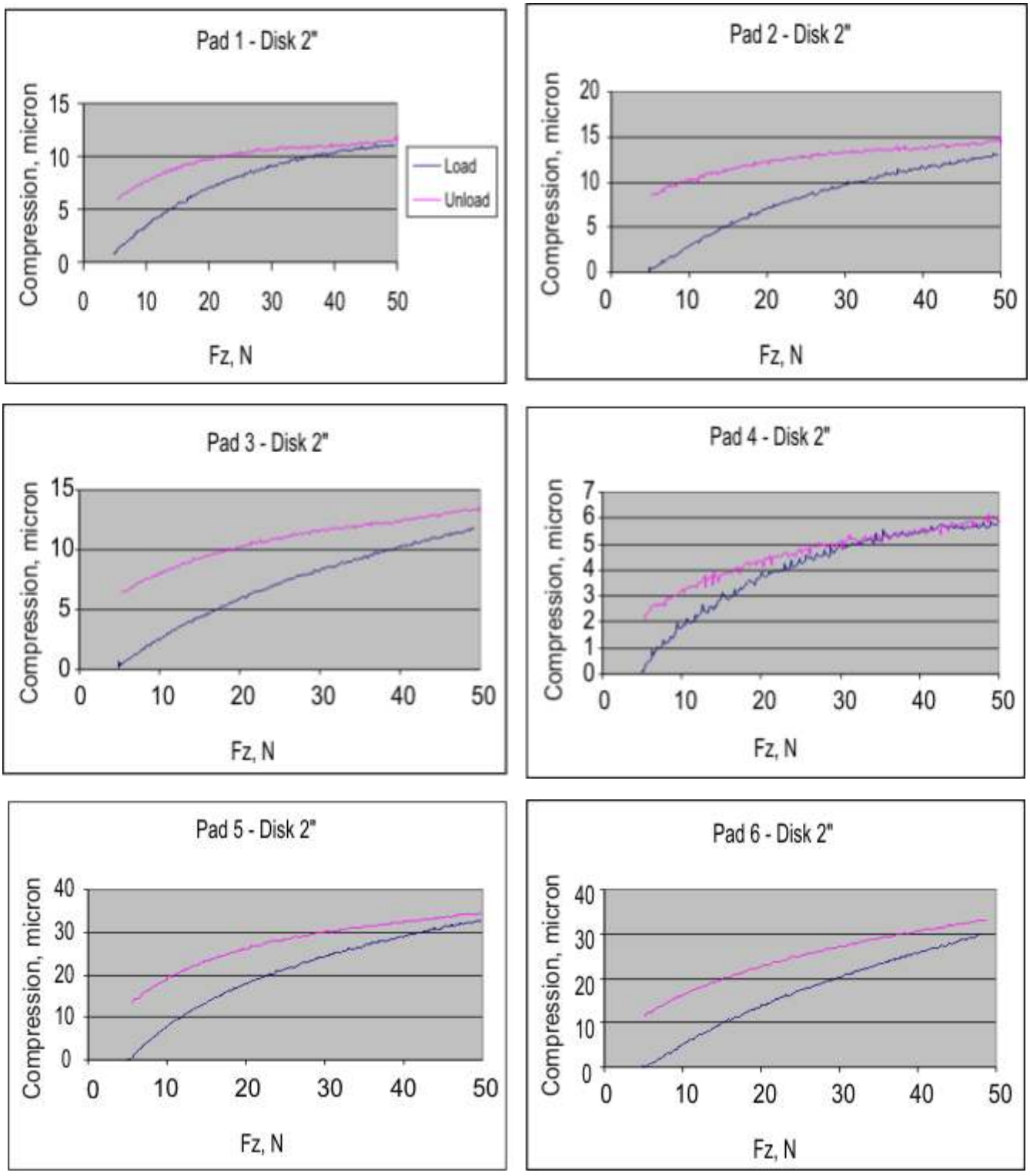
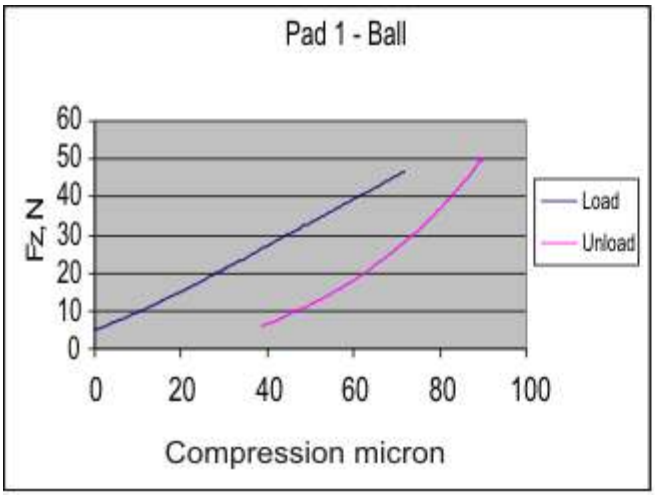
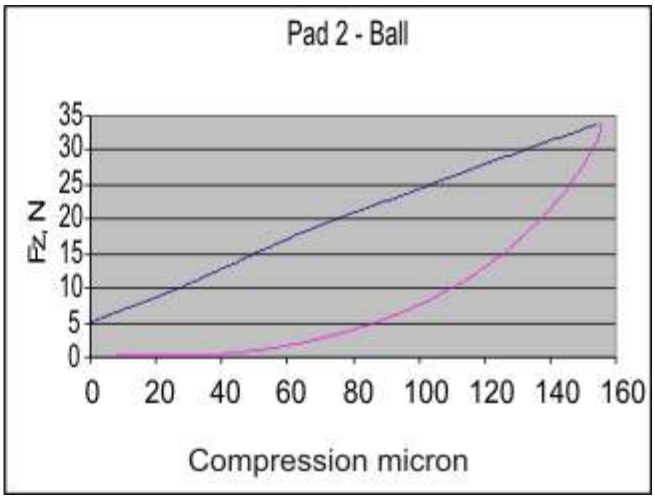
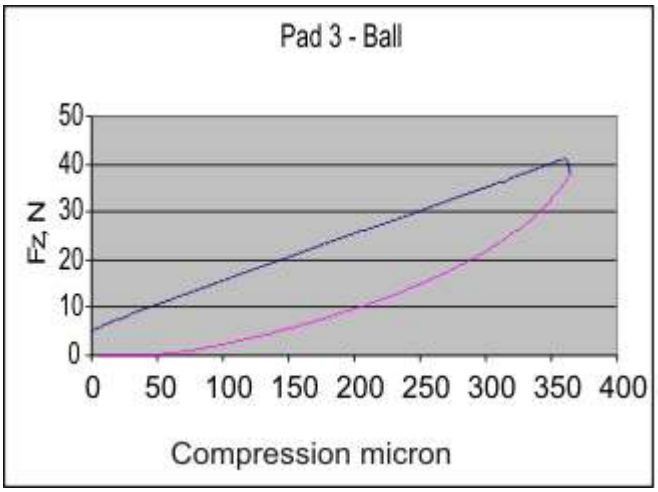
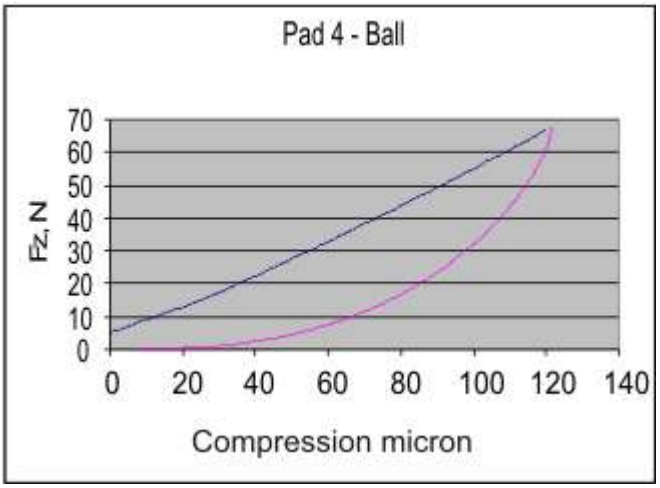


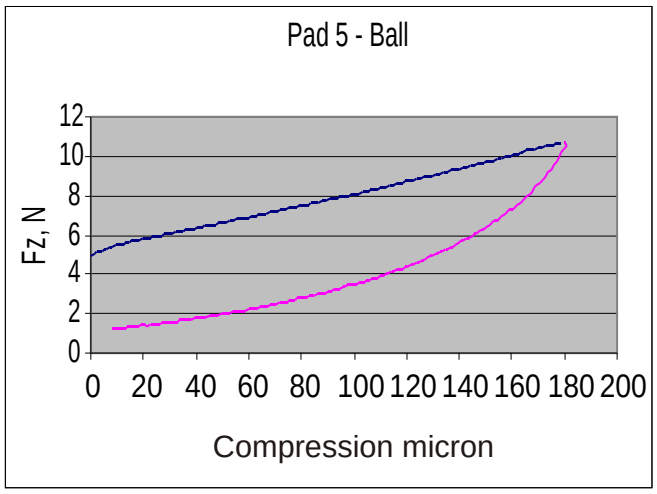
Fig. 3. Compression Test Data for Disc on Pads 1 to 6











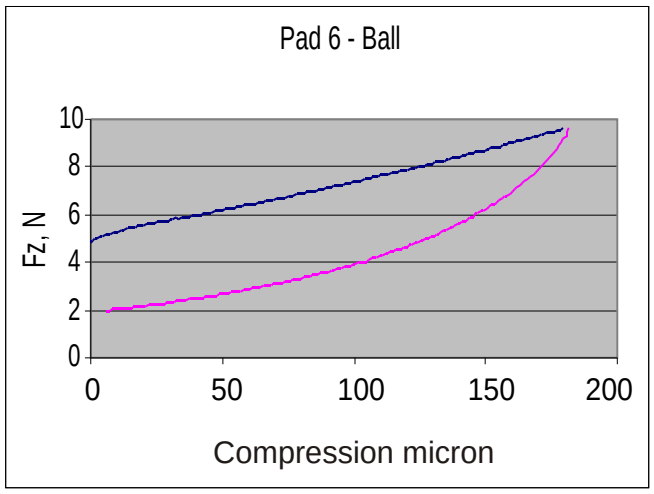


Fig. 4. Compression Test Data for Ball on Pads 1 to 6

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