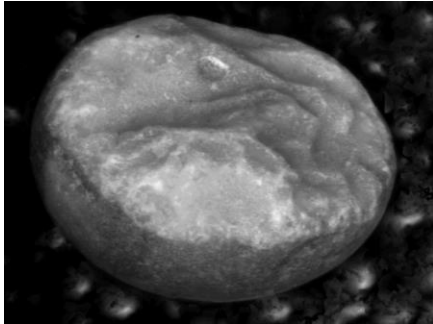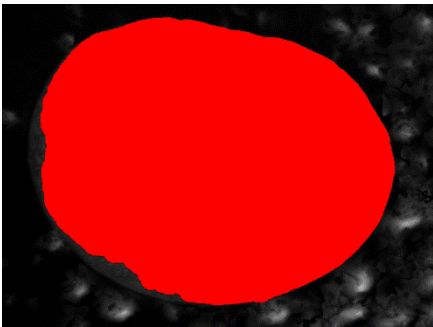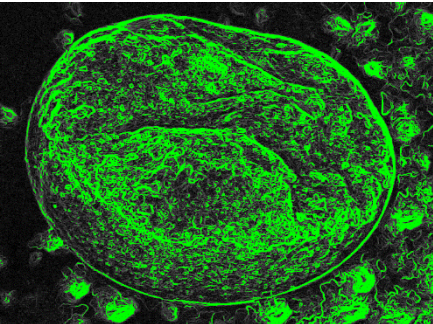# CERAMIC BALLS MORPHOLOGY

Figure 1: *Original image of sample #3 (worn ball) using Multi-Layer Grab views at 50X.*

Figure 2: *Red Thresholding of the ball surface.*

Figure 3: *Kirsh transformation of the original image enables the wear texture to be detected and associated with green bitplane.*

Equipment

Image Analysis System:	Clemex Vision PE
Microscope:	Nikon Optiphot-150 with reflected light on black background
Camera:	Sony XC-77CE B&W
Magnification:	50X
Stage:	Marzhauser EK8B-S1 (75x50 mm)

Sample Description

Four small vials were received, containing balls used in the refining industry for fragmenting petroleum molecules. The vials are numbered from #1 to #4. Vial #1 contains new balls, #2 contains slightly worn balls, #3 contains worn balls, and vial #4 contains fragmented balls.

Purpose of Analysis

Demonstrate the ability of the Clemex Vision image analysis system can classify a group of balls by degree of wear. The classifications mentioned in the sample description are the ones to be used.

Procedure

The analysis was made on a black background, using reflected light, with the balls placed on a sticky surface to ensure that they would remain motionless. By using the Multi Layer Grab instruction, an image of the ball appeared to be in focus over the whole surface. The surface of the ball was binarized into red. The degree of wear can be extracted from the gray levels underneath of the red bitplane. The surface texture of the ball can be identified through Kirsh operation and represented by green bitplane. The ratio between green and red bitplanes allows the classification of the ball's texture and forms a third wear index. Using these indices, the categories of objects can be defined.

Results
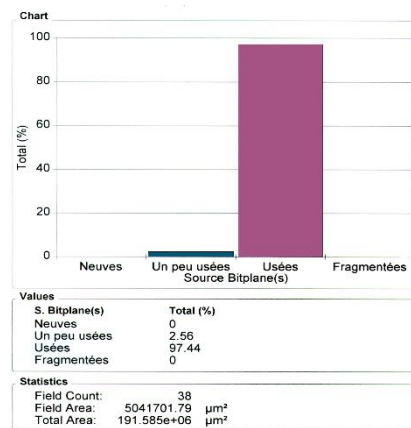
Figure 4: *Results indicate the percentage of ball in each category for sample #3. (Neuves: New; Un peu usées: slightly worn; Usées: worn; Fragmentées: Fragmented).*