# Screen Scratches

## Executive Summary

Optimet's NanoConoprobe with a 25 mm focal length lens was used in the application of automatic inspection of scratches on screen top surface. (Alternatively, one could use the Nano9000 combined with a simple vision system.) The main industrial application during the automatic inspection of screen scratches is related to the scratches' properties such as depth and width, which determine whether the screen can be refurbished by polishing according to the predetermined criteria or not.

Optimet's Conoscopic holography technology is highly qualified for cell phone screen inspection, as it permits scratches to be measured and evaluated using a single cross scan at the middle of the scratch (deepest area).

The features were measured with a high sampling rate of 3000 Hz, which allows high scanning speed.

## 1. Optimet's Advantages over Other Technologies:

1. Conoscopic holography – permits scratches to be measured and evaluated using a single cross scan.
2. Collinearity – enables measurements inside and to the bottom of the scratches in order to evaluate depth.
3. High lateral resolution
4. High sampling rate with no need for averaging

Optimet is very familiar with this type of market application - The NanoConoprobe is already in use as part of the inspection process of phones and phone products by manufacturers in China and Korea.

## 2. Application Description

In the refurbishment process of a cell phone (fig. 1) with scratches on its screen surface, it needs to be determined if the glass defects can be restored by means of polishing the glass surface.

**Figure 1 - Nano 9000 Sensor and cell phone**

## 2.1 Method

Using Optimet's NanoConoprobe with a 25mm focal length lens, the scratches on the screen top surface were scanned and analyzed for deformities. Scratch properties such as depth and width will determine if the screen can be refurbished by polishing according to the predetermined criteria.

**System setup**

- Sensor type : NanoConoprobe.
- Lens focal length: 25 mm
- Sample rate: 3 kHz

Note:

The new downsized sensor Nano9000 (fig.3) is an existing option for this application. (Main features: small size, 9 kHz measurement rate)

**Scanning setup**

- Sensor sampling frequency: 3 kHz
- Laser power setup: 22 (~40 µW)
- Step along the line (X direction): 2 µm
- Step between lines (Y direction): 5 or 10 µm
- Room temp: 23~24 ºC


**Figure 2** - Nano 9000 Sensor

**Sample scanned**

4 samples were scanned:

- Sample 1: DYB5PA - Defects by quality assurance that can be restored
- Sample 2: DZB1KA - Defects by quality assurance that can be restored
- Sample 3: DZAC3A - Defects by quality assurance that can be restored
- Sample 4: DZB3BA - Defects that cannot be restored

# 3. Results and Observations

**2-D Scan of sample 1: DYB5PA**

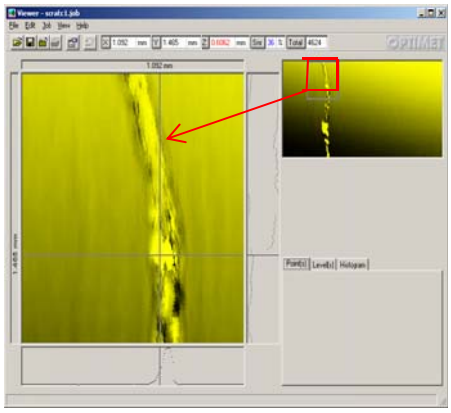

**Figure 3** - Sample 1, 2D Scan

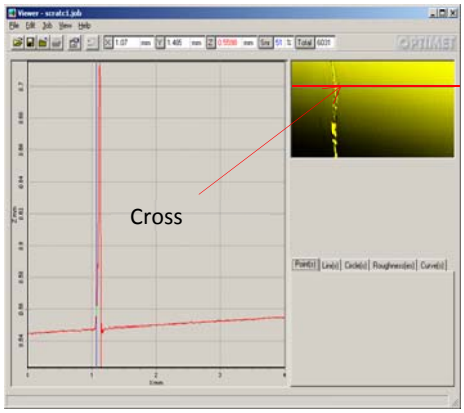


**Figure 4** - Sample 1, cross section

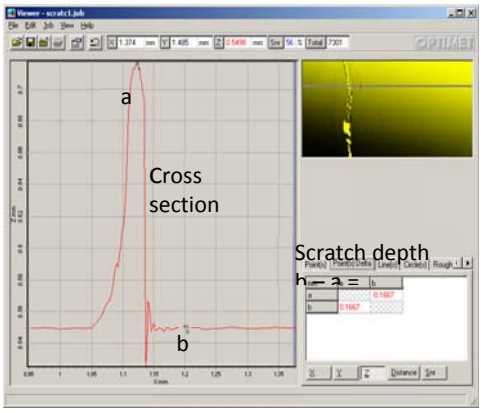


**Figure 5** - Sample 1, zoomed cross section

## 2-D scan of Sample 2: DZ81KA

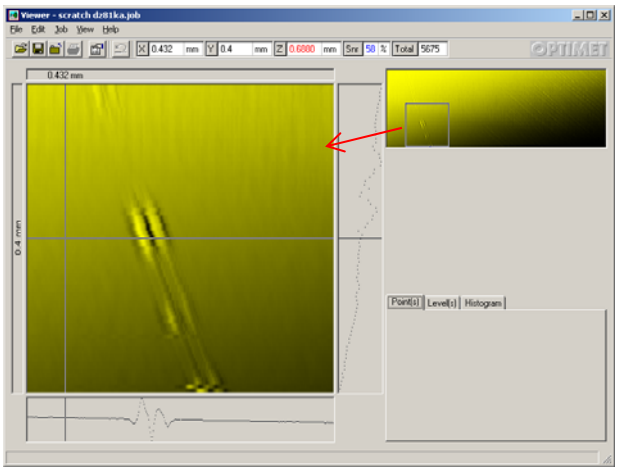

**Figure 6** - Sample 2, 2D Scan

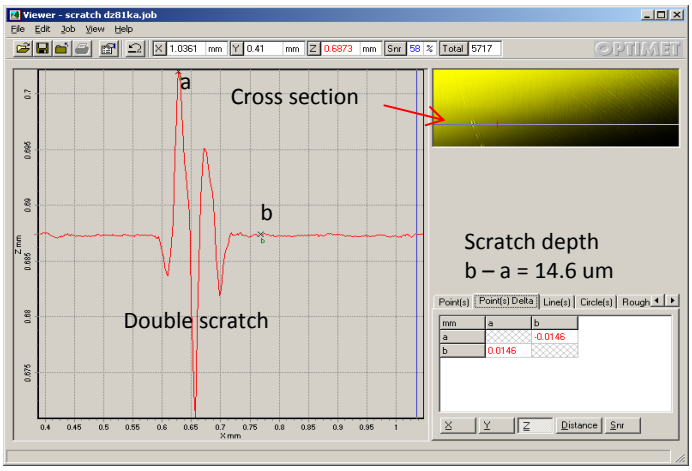


**Figure 7** - Sample 2, cross section

## 2-D scan of Sample 3: DZAC3A

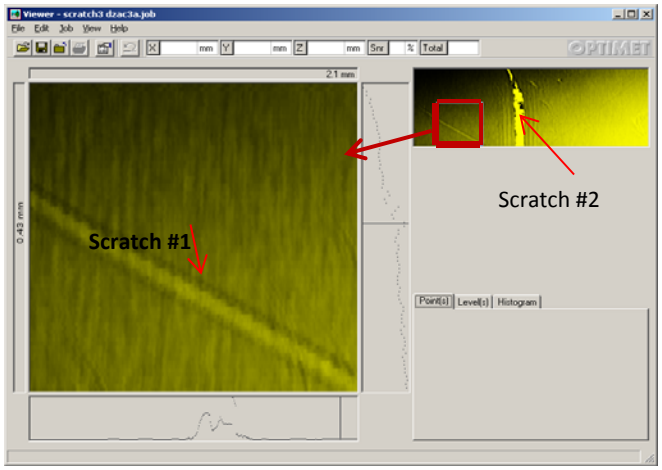


**Figure 8** - Sample 3, 2D Scan

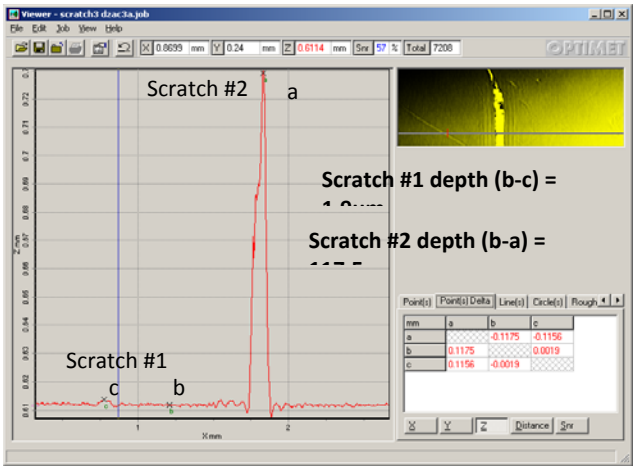


**Figure 9** - Sample 3, cross section

## 2-D scan of sample 4: DZB3BA

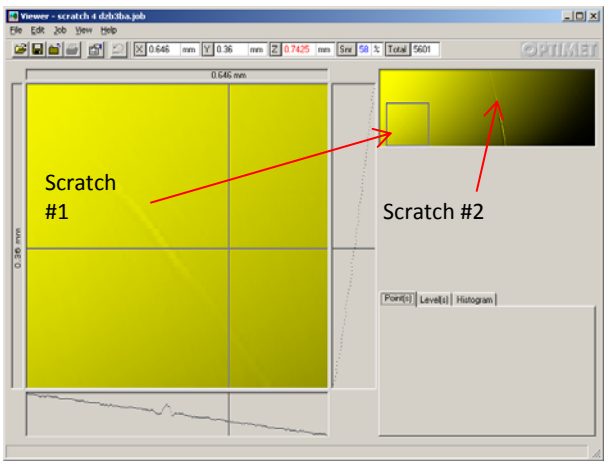


**Figure 10** - Sample 4, 2D Scan

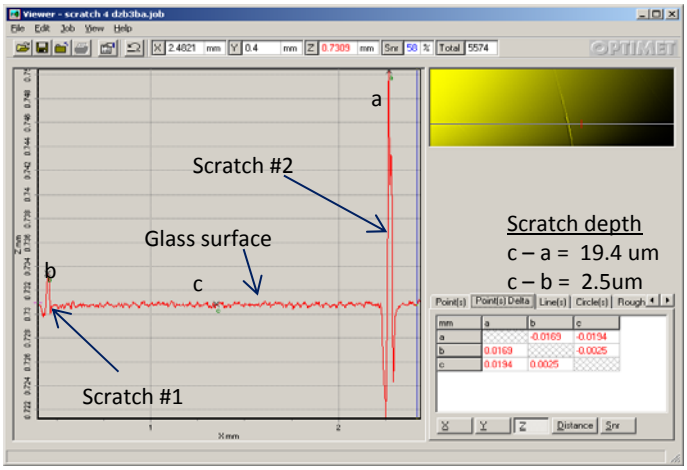


**Figure 11** - Sample 4, cross section

## 4. Data:

| Parameter | Value |
|---|---|
| Reflective/Diffusive/Transparent/Translucent | Transparent |
| Working Range (mm) | 1 |
| Precision (µm) | 0.5 |
| Stand Off (mm) | 16 |
| Max. Data Rate (KHz) | 6 |
| Lateral Resolution(µm) | 2*5/2*10 |
| Z Resolution(µm) | 0.1 |
| Application Category | - |