Three Dimensional Visualization and Comparison of Micro-Impressions

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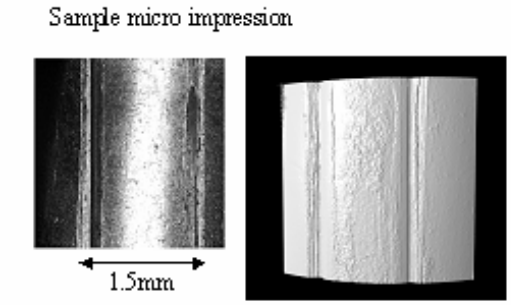
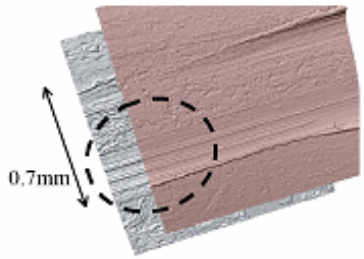
Currently, optical devices, such as microscopes and CCD cameras, are utilized for identification of bullets and tool marks in the field of forensic science. While these optical methods are easily manageable and effective, they are under great influence of illumination condition. In other words, appearances of striations through these optical devices have possibility to be changed by lighting condition. Besides these appearance-based approaches, we can utilize 3D geometric data of tool marks that are free from lighting condition. In this study, we focused on 3D geometric data of landmark impressions on fired bullets for identification. We obtained the 3D surface data of tool marks by a confocal microscope and reconstructed virtual impressions on a PC monitor from the geometric data. Furthermore, the 3D data are exploited to numerical matching of two surface shapes. We also visualized the difference of two shapes. In order to do this, two surface models are aligned automatically. In this process, pairings of correspondent points on both surfaces are determined. Distance analysis between these pairs leads to a shape comparison. Since comparison results are visualized, they are intuitive and easily perceptive.

Publication

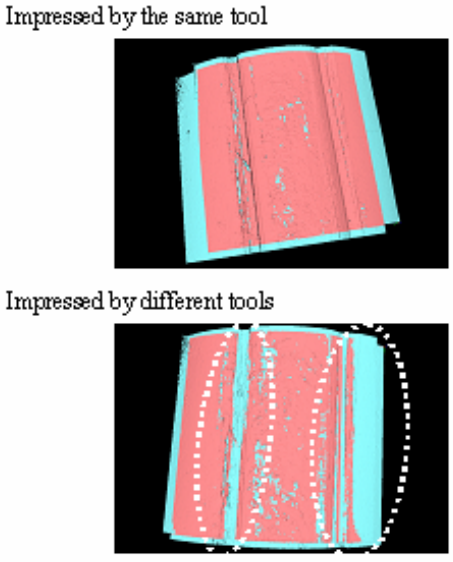
1. **A. Banno, T. Masuda and K. Ikeuchi, "Three dimensional visualization and comparison of impressions on fired bullets", Forensic Science International, 140, pp.233-240, Mar., 2004.**



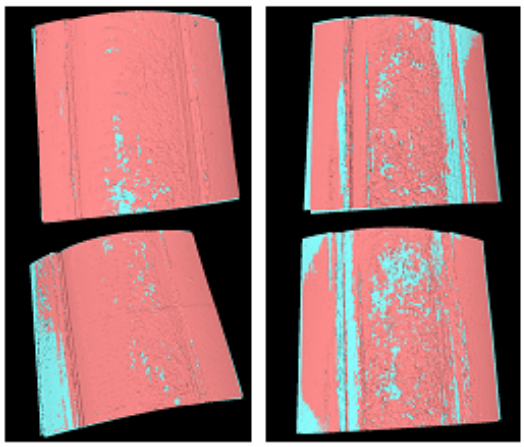
A photo and the 3-D virtual impression



Visual comparison of virtual impressions



Geometric comparison of two surfaces



The dark gray region indicates where the distance of two surfaces is less than threshold (0.015mm). The light gray region, where the distance of two surfaces is over the threshold, is spread along the scratch direction, in spite of overlapped part.