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TECHNIQUE FOR DEVELOPMENT OF HIGH-RESOLUTION FINGERPRINT IMAGES FROM CURVED SURFACES

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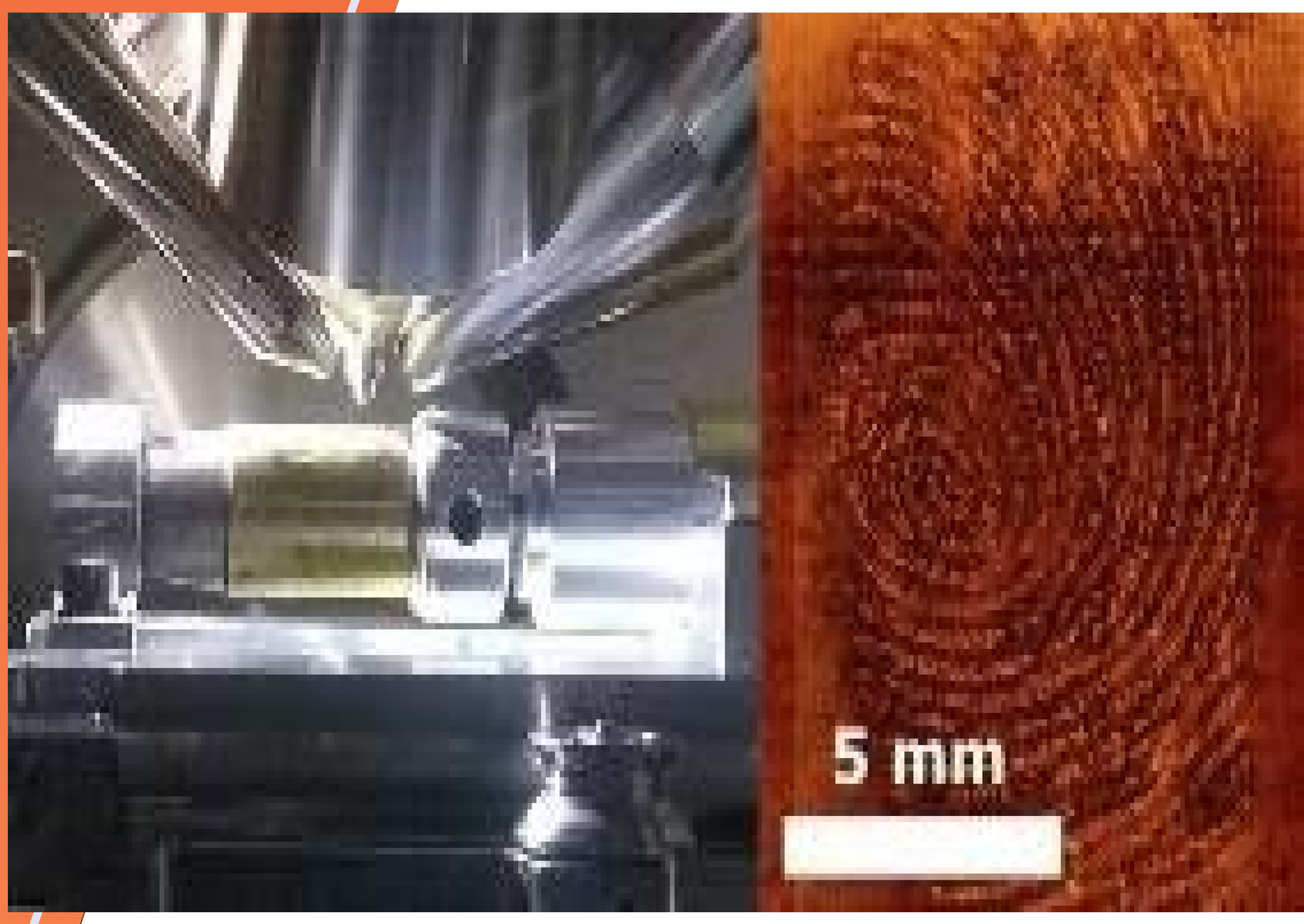

Credits: University of Nottingham

A fingerprint is one of the important pieces of evidence found in the crime scene as it helps to identify the suspect and link the suspect to the crime scene. Fingerprint plays a significant role in the field of Forensic Science, but it is not always found intact in the crime scene. It may often be distorted or partial or present on surfaces from where the images of the print cannot be obtained in a condition in order to examine partial or present on surfaces from where the images of the print cannot be obtained in a condition in order to examine it later and obtain accurate results, which are very important to convict the wrong-doer.

The University of Nottingham has worked in every aspect to develop a method to obtain high-resolution fingerprint images from curved or challenging surfaces.

James Sharp, an associate professor in the school of physics and astronomy, and his team developed a technique based on spectrometry known as the time-of-flight secondary ion mass spectrometry along with a significant creation of a rotation stage, which actually helps us to study the fingerprint deposited on curved objects bullet, metal casings, and other surfaces.

The ToF-SIMS (Time-of-Flight Secondary Ion Mass Spectrometry) is a technique in which high energy beams of positive ions are made incident on the sample surface to free secondary ions from the surface as they collide with any material. The ions are then accelerated on the ToF analyzer. They are distinguished based on the mass-to-charge ratio; it produces a spectrum that provides a very detailed image of the chemical composition on surfaces of the sample.

How does this help obtain the high-resolution images on curved surfaces like bullets or metal casing of a firearm?

Basically, when a bullet is fired, the metal casing experiences and undergoes changes due to the environment as it is subjected to factors such as high temperature, pressure, and friction. The propellant and the powder residue generates a reaction process that ejects the bullet out of the chamber.
These combined factors often result in removal, degradation, or evaporation of the volatile compounds of fingermark residue like water, lipid, amino acid, and obscuring, or smudging of the mark. The scientists of the University of Nottingham state that these factors may complicate the conventional retrieval of fingerprint marks such as cyanoacrylate fuming and fluorescent staining.

The experts in the University of Nottingham conducted research for a period of over 7 months and were able to obtain high-resolution images of the fingerprint images, ridge characteristics, and the sweat pore details, which was not the case in the conventional method such as cyanoacrylate fuming and basic yellow 40 dye. The rotation stage is a significant feature that helps study the fingerprint marks in detail.

The main aspect that we should look into is that the conventional techniques did not provide reliable and accurate detailed images. With the imaging obtained with the conventional technique, it was seen that there was a degradation of the quality of the image in a period of 8 days, whereas it would not be visible or recognizable after 3 days and gave no result after a period of 14 days. In the case of ToF SIMS, one of the advantages is that in the ion beam, they were able to detect, visualize, and examine the sample up to 26 days after collection.

According to Sharp, the experts proved that ToF SIMS provides detailed high-resolution images with accurate details on different surfaces.
The addition of the rotation stage is significant as it helped in studying the fingermarks on the surface in detail with less difficulty and covering the whole surface of the sample from which the image is to be obtained. It is even non-destructive, so it keeps the evidence intact while it is being examined. The high-resolution images provide accurate results, which help in identifying the suspect or linking the suspect to the crime scene or firearm ammunition.

Sharp is continuing to work on this technique of obtaining images from the curved surfaces on the rotation stage.
This technique, along with the rotation stage, may be a very productive contribution to the field of forensic science as it makes it easier for the experts to examine the fingerprint impression to study the characteristics, ridge details and obtain a high-resolution image which helps to narrow down and link the suspect to the crime scene.
Obtaining fingerprint impressions on curved surfaces was an aspect of difficulty when conventional methods of imaging were used.

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