



## **Investigation of Frauds in Signature Rubber-Stamps**

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**Abstract.** In the 21<sup>st</sup> century, new digital electronic technologies like computer, scanner, digital camera, computerized photo-stat machines and different types of printers, editing softwares are used, which can be utilize to commit document frauds. Rubber-stamps are used as an official seal describing government, private officer's designation, department information etc. They sometimes use rubber-stamp for authentication, certification or verification of original documents. Fraudster uses digital technology to develop imitation of 'signature rubber-stamp' to perform white caller crime. Such rubber-stamps containing 'Signatures' and utilize it for committing crime by applying on documents. This is a case study, which defines a specific modus operandi used by fraudsters in India. Authors have investigated such modus operandi of fraud, which is very difficult to identify by a layman. This type of modus operandi could only be detected with the scientific instrument namely VSC-6000/HS with different functionality. The main aim of this research work is to develop simple, rapid, sensitive, eco-friendly and non-destructive method to identify signatures applied with rubber-stamps. The research in such field will be directly beneficial to society, financial institutions, law enforcement agencies which give additional motivation to do research for examination of questioned documents.

**Keywords:** Bank fraud; Forensic sciences; Questioned documents; Signature rubber-stamp.

### **1. Introduction**

Research and development are always beneficial for the society, but sometimes white-collar criminals misuse it for their own benefit and to commenting financial

frauds<sup>1</sup>. White-collar crime is an act of the unlawful, intentional committing of deceit, subterfuge, manipulation, breach of trust, organised and pre-planned and it gets placed without physical violence<sup>2,3</sup>. Literatures and survey reveal that, in the modern era document frauds are growing rapidly, because of increase in scientific knowledge, literacy, unemployment, get-rich-quick syndrome, short cut for success, negative aspects of computer & internet, improvement & progress of new digital technology etc.<sup>4,5</sup>. A fraud occurs, where one makes a material misrepresentation of facts in order to achieve a financial gain<sup>6</sup>. Documents and signatures play a vital role in legal aspects like property related matters and also in personal identifications<sup>7-9</sup>. Fraudsters targets the financial institutions rely on signatures for account openings, cash withdrawals and other transactions<sup>10-12</sup>. Generally, fraudsters use tracing techniques, cut and paste method, highly sophisticated technologies like image editing software, hardware, digital camera, printing and scanning to imitate genuine documents, addition, deletion, substitution and to produce a tempered fraudulent document<sup>13-22</sup>. Fraudster utilize such tempered documents as a genuine document with malicious intention to perform crimes, which could not be identified by a layman. This has led to a substantial increase in bank frauds<sup>23,24</sup>. It has also attracted many smart fraudsters and created a flourishing trade of manipulated documents on internet<sup>25</sup>. Such manipulated documents can be used to gain a financial benefit. Meanwhile fake passports and visa of various countries with fake immigration stamps can be easily available on 'Dark Web'. These fake documents can be used to get illegal entries to different countries<sup>26</sup>. Generally, fraudster uses following steps to prepare the stamp using digital techniques like obtaining the original documents, high resolution scanning, digital image manipulation and final printing using with the help of different technologies of printers<sup>27,28</sup>. One such application of technology is in committing frauds by using rubber-stamp of signatures on cheques and other essential documents. It is beyond one's imagination that, such frauds can be done in this way without tempering of signatures. Rubbers-stamp can be recognized as a stamping. It is a one type of craft, which is made of different types of inks containing dyes or pigment with other chemical, which can be applied to a specific image or pattern that has been moulded, curved vulcanized or laser engraved, on a piece of rubber sheet. The ink is coated on the sheet of rubber and then pressed on to a type of medium, such that coloured image will transfer on paper or other writing surfaces<sup>29</sup>. Recently, we have studied thermal ink used in bank frauds. During the

investigations, we noticed that thermal ink frauds could be detected under specific ultra-violet light range between 312-365 nm and spot light, which are available in VSC-6000/HS<sup>30</sup>. In the present case study, we propose to investigate the rubber-stamp prepared using digital technologies with unique *modus operandi*, during the interrogation with fraudster in India. Authors has investigated as a case study of such kind of rubber-stamp prepared using digital technologies, which can be easily available and manufactured by local vendor in India. To the best of our knowledge this type of case study has not been reported earlier.

## 2. Materials and Methods

### 2.1 Pen

Black colour ball point pen with 0.3 mm tip manufactured by M&G®, model No. K-04 was used for signatures, which were scanned to prepare the signature rubber-stamps, one 0.5 mm blank pen used to create the pressure marks deliberately, one 0.5 mm black colour gel ink pen manufactured by cello®, were used for the purpose of writing on the samples of cheques like date, payee name, amount in figures, amount in words except the signatures in all the cheques and cash withdrawal slips etc.

### 2.2 Paper

In proposed case study, we utilized (30) Thirty bank cash withdrawal slips & (30) Thirty obsolete bank cheques, which are consider as a sample. Here, we also used tracing or butter paper for scanning process of signatures.

### 2.3 Instruments and equipment

The instruments and equipment used in the investigation are listed in Table 1.

**Table 1.** List of scientific instruments and digital peripherals used in proposed case study.

Instruments & equipment	Descriptions	Manufacturer/Suppliers
Hand magnifier with Ultraviolet lamp	Corning, 9 V–50 Hz with 10X magnification	Pia international®
VSC-6000 HS®	Connected to a monitor with different functions are used for the study	Foster and Freeman®, London, U. K

Scanner: Scanjet G4010	4800x9600, DPI resolutions	HP®
Printer: LaserJet M1136	For printing the signatures	HP®

## 2.4 Sample preparations and method

In our case study, authors have utilized (30) bank cash withdrawal slips and (30) bank cheques, signed them using such rubber-stamp prepared by digital techniques along with different model of own signatures for the evaluation of new modus-operandi. For control samples, gel pens were used to apply signatures on the bank cash withdrawal slips and cheques.

## 2.5 Casework description

We utilised entire samples, only for research purposes. During the case work, precaution was taken during applying different signature rubber-stamps on different places of the cheque; say one signature rubber-stamp was applied on the front side and one different signature rubber-stamp was applied on the back of the cheque because even different genuine signatures are never identical and always contains natural variations<sup>31</sup>. It is obvious that applying of the signature rubber-stamps on bank cash withdrawal slips and bank cheques does not leave any indented marks. Such marks were deliberately created with a blank 0.5 mm writing instrument. In our case study, to create the indented marks, a blank ballpoint refill having round tip without ink was carefully applied on the signature strokes. The blank refill did not disturb the colour of the rubber-stamped signatures and it creates only indentation marks visible on the back and front side of the cheques, which shows illusion of genuine writing.

## 2.6 Discussion

Sample signatures were scanned under high resolution of 4800x9600 DPI (Dots per Inch). DPI is used to measure the resolution of an image both on screen and in print. As the name suggests, the DPI measures, how many dots fit into a linear inch. Therefore, higher the DPI more the details can be shown in an image<sup>32</sup>. If the signatures are scanned in low resolutions like (300) DPI, the impressions of the rubber-stamp signatures are fragmented and can be easily identified in form of broken dots by naked eyes. In high-resolution scanning, the impression of the

sample signature stamp will not fragment, because the dots are very congested to each other. Advancement of technology, easy availability of computer editing software, image enhancement techniques and scanning methods has revolutionized manufacturing of signature rubber-stamps<sup>33</sup>. Rubber-stamps of signatures are prepared by scanning the genuine signatures using digital scanners, preparing negative of the same on special non-porous butter paper, which allows the ink to pass through the signature lines only and then preparing rubber-stamp of the scanned signatures by pasting the negative on a piece of rubber sheet and this is how a “signature rubber-stamp” is prepared using digital techniques. Ink is used to put impressions of such signatures rubber-stamps on the paper<sup>34</sup>. As such, signature rubber-stamp is a middle stage between digitally printed signatures and signatures done manually. Liquid detergent is mixed with dye or pigments to prepare ink of the signature rubber-stamp, which distinguish if the rubber-stamped signatures were done manually using a gel pen or a high-tech liquid ink pen. It is obvious that, the size of scanned signature pixels are increases a little bit during the scanning and manufacturing process<sup>35</sup>. To overcome the sizing problem the signature sample was written with a pen of 0.3 mm ball point gel ink and scanned with digital scanner. Some wear and tear marks are inadvertently created on the rubber-stamp during manufacturing process. Adhesive was applied on such marks on the negative to hide them, before preparing signature rubber-stamp. Authors have prepared self-ink rubber-stamp with black colour ink, which is generally used in documents. The ink was prepared by mixing liquid black colour and ordinary thick liquid detergent. After finishing manufacturing of signature stamp authors has tested impression of such signature stamp strokes and observed the thickness of strokes, which remains between 0.5 mm to 0.7 mm. This signature looks similar to hand written signature strokes. The careful removal of the manufacturing marks from rubber-stamp does not leave any visible rubber-stamp marks on cash withdrawal slips and bank cheques except signature.

## **2.7 Examination of the samples:**

For the investigation of such type specific and unique modus oprandi of frauds, we used non-destructive analytical method. We have utilized hand magnifying glasses and VSC-6000/HS for the examination of questioned documents. The tremors and line quality created on paper deliberately by using blank ball point pen were not

observed under 10x hand magnifier. So, author has examined such samples under highly sophisticated scientific instrument like VSC. During the manufacturing process, some were and tear marks are also producing, which are also not visible with naked eyes as well as hand magnifying glass in this case study. In such conditiones, we have utilized VSC-6000/HS for further investigations.

### 3. Results

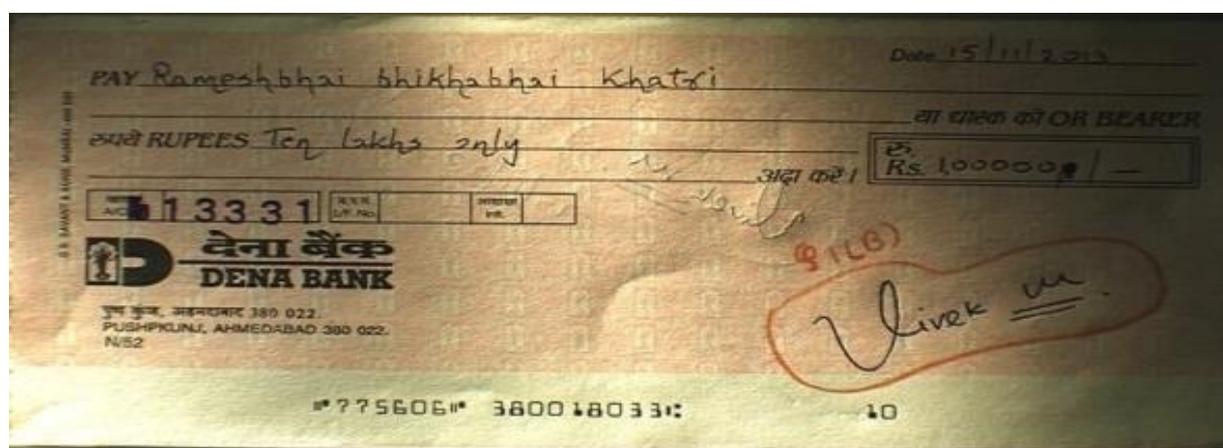
Authors has utilized bank cash withdrawal slips and bank cheques, signed them using such rubber-stamp prepared by digital techniques. Other-side for control samples, gel pens were used to written payee name, amounts in figures and words and date on the bank cash withdrawal slips and cheques. It was observed for 3 months, both the inks (signature rubber-stamp ink and gel pen ink) are very durable at room temperature as well as 25° C to 35 ° C. Both types of samples were kept under VSC-6000/HS, and photograph of collected samples were compared periodically with each other. Specimens from both samples were kept under the exposure of direct sunlight (35 °C to 45 °C) and observed after Three 3 months. It was noticed that, the tint & lustre of gel ink of the control samples faded a little bit and signature stamping ink not faded, but still easily readable. Specimens from both samples were kept under the room temperature as well as exposure of direct sunlight. We noted that after 10 months the gel ink tint & lustre of the control samples faded little bit but the tint & lustre of the signature rubber-stamps ink is not faded.

**Table 2.** Durability of inks of rubber-stamp and control sample (black gel ink).

Total (60) samples	Samples of cheques with rubber-stamp inks (30) [A]	Control samples of withdrawal slips with black gel pen ink (30) [B]	Period in months	Temperatures in °C	Results of samples [A]	Results of samples [B]
20	10	10	3	25°C (room temperature)	Ink is durable at room temperatures	Ink is very durable at room temperatures
20	10	10	3	35°C to 45°C (sunlight)	Ink strokes of rubber-	Tint & lustre of ink strokes

					stamps are not faded	are little bit faded
20	10	10	10	25°C to 45°C (room temperature + sunlight)	Ink strokes of rubber-stamps are not faded	Tint & lustre of ink strokes are little bit faded

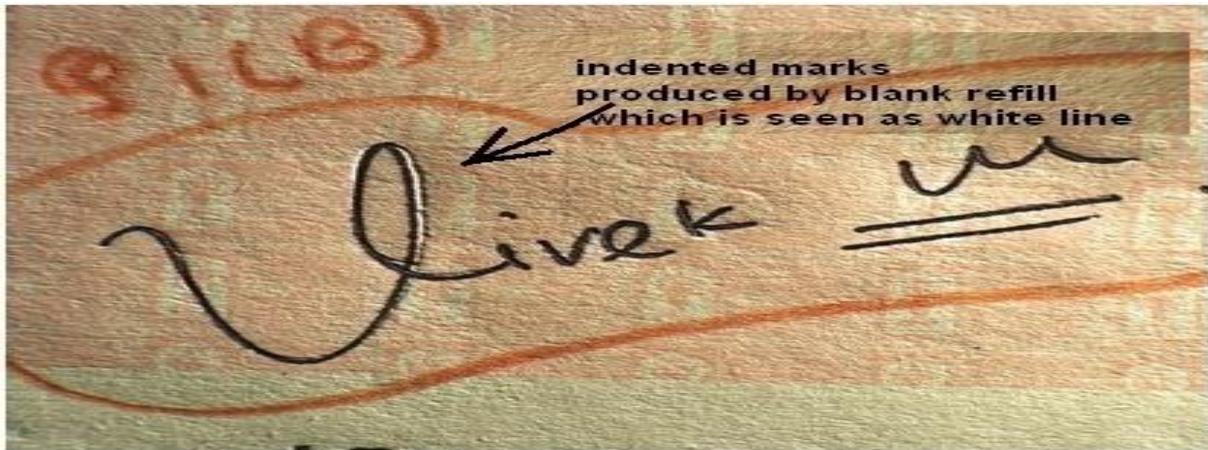
In this case study, samples were prepared by writing the date, payee name, amount in figures and in words by using 0.5 mm tip black gel ink pen manufactured by cello®. Figure 1 shows the photograph of such a sample observed under VSC. Figure 2 shows higher magnification effect of signature stamp of Figure 1 with left side angular light under VSC-6000/HS. After stamping the signatures on cheque with signature stamp, signatures were overwritten by blank ballpoint pen with 0.5 mm tip, which created writing pressure marks, writing strokes of signatures. Signatures were overwritten to create the pressure marks of handwriting deliberately, so it will not identify to be felt during physical examination. VSC examination shows right side and left side oblique light effects and as indicated by black arrow.



**Figure 1.** Photograph of the signature rubber-stamp indicated by Q 1(B) in red circle.

Figure 3 is also a sample of signatures put with a signature rubber-stamp on a sample. Figure 4 is the sample of signatures put with a signature rubber-stamp, which was examined under the VSC with higher magnification. It was also viewed under left side angular oblique light. Prepared sample shows breakage and tremors at curvature of English alphabet 'e' and 'm', which is seen as white line in signatures

indicating that the pressure marks are not genuine because the natural flow of the pen remains continuous and unbroken during putting signatures.

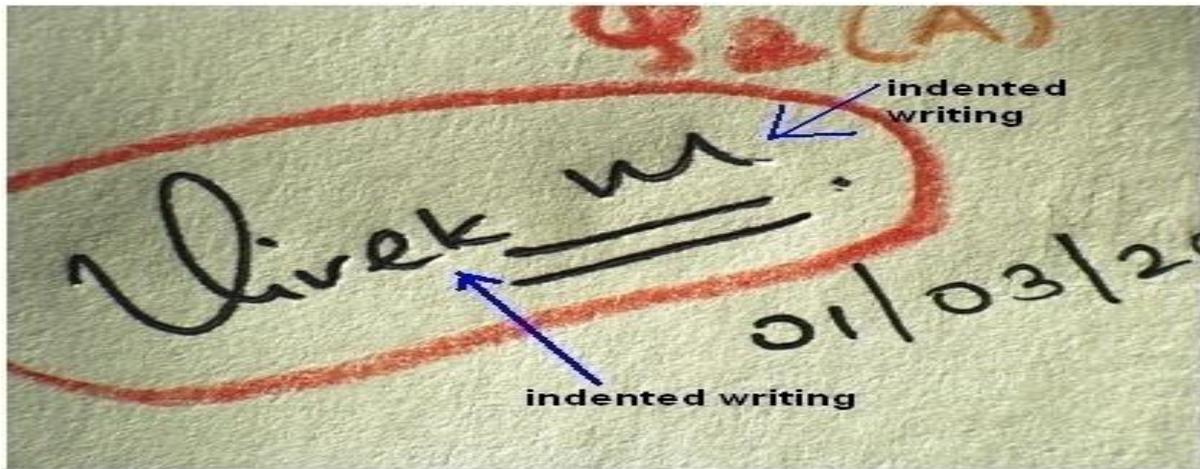


**Figure 2.** Higher magnification of signature rubber-stamp of Figure 1, with left side angular light under VSC 6000.

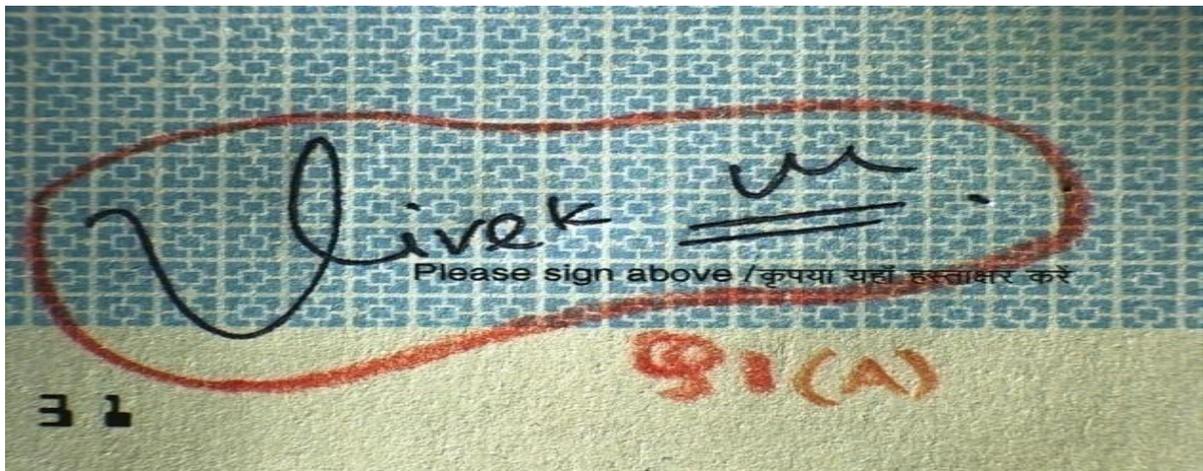


**Figure 3.** Photograph of sample of signature rubber-stamp, with deliberately created pressure marks.

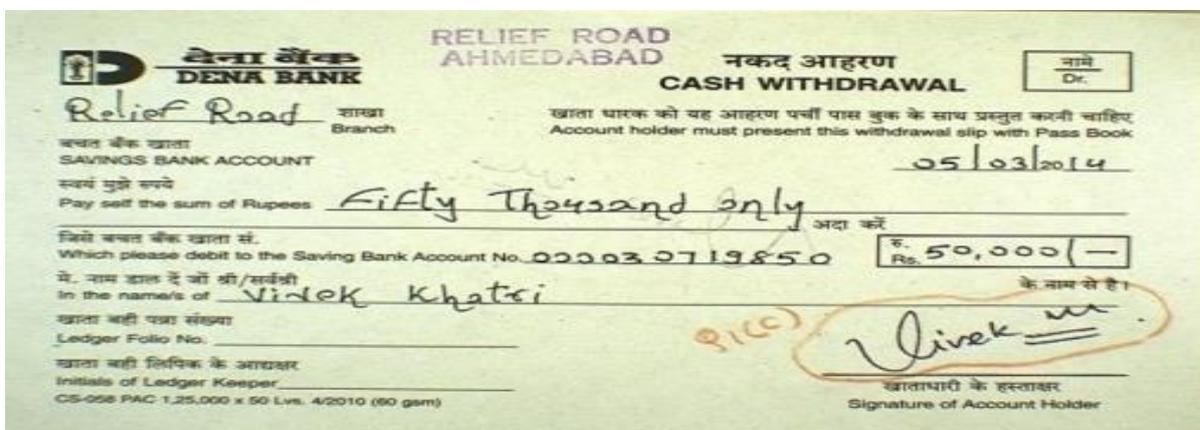
Figure 5 shows another sample of signatures put with a signature rubber-stamp, which was examined under VSC with higher magnification and observed writing/pressure marks, indented writing at the curvature of the middle body part of the signatures as well as the terminal part of the letter “m” with white colour. Figure 6 shows another sample of signatures put with a signature rubber-stamp on the bank cash withdrawal slip, which is indicated by red encircle.



**Figure 4.** Photograph of pressure/indented marks observed in the terminal stroke of 'e' and 'm', which is indicated by a blue arrow, even date was written with normal cello® black gel ink pen in above signature.

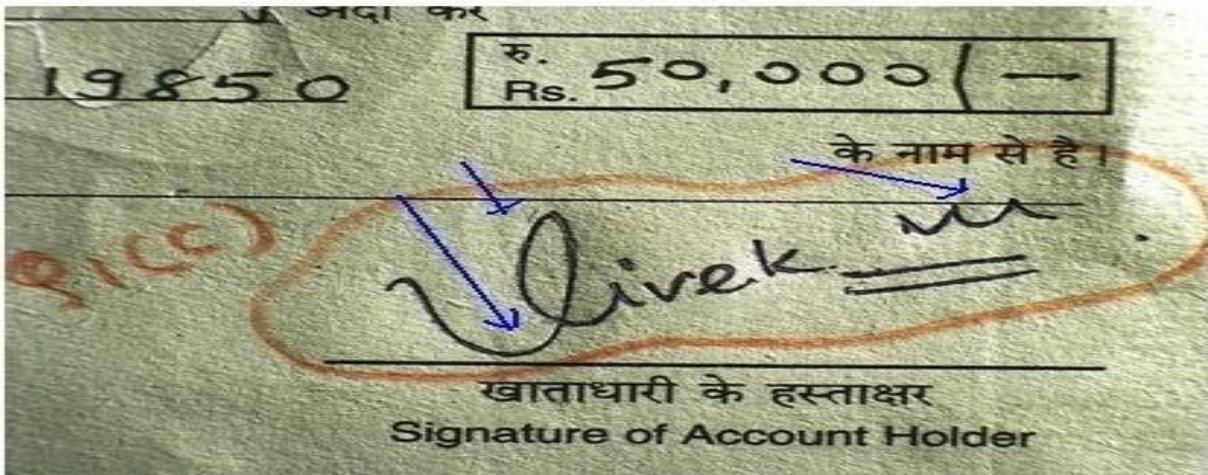


**Figure 5.** Photograph of high magnification of the signature stamp with left side oblique light in VSC 6000 HS.



**Figure 6.** Photograph of signature stamp, which is indicated by Q1(c), encircled by red pencil on cash withdrawal slip.

Figure 7 shows the higher magnification of Figure 6 and higher magnification of the deliberately created writing/pressure marks, which is observed as a white line indicated by the blue arrow in the English alphabets, curvature of the body part of “V” and shoulder & hump of ‘m’, which was examined under the VSC. Figure 8, we observed the impressions of the digital rubber-stamping signatures at 61X higher magnification under VSC. The signature rubber-stamp ink was mixed with liquid detergent and dye, which is absorbed in cheque’s fibres and gives illusion of normal pen ink.

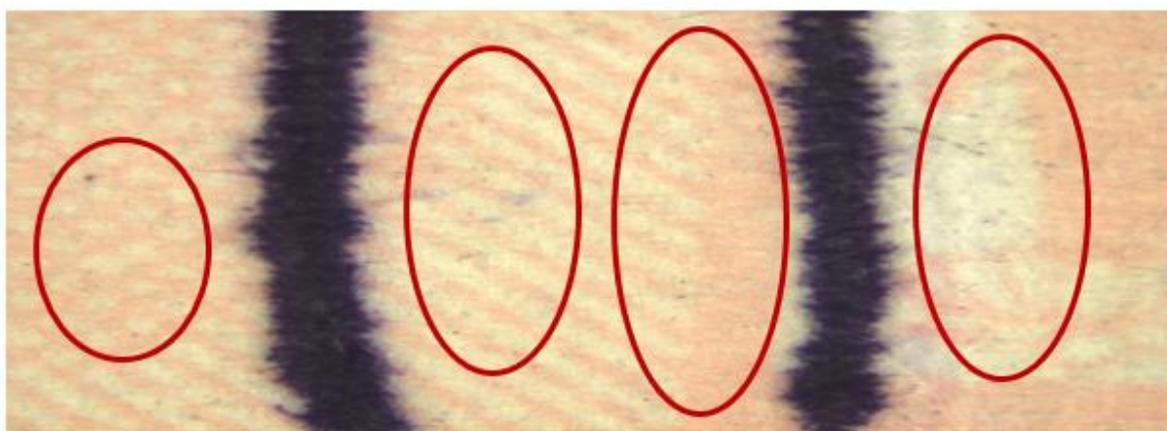


**Figure 7.** Photograph of indented marks indicated by blue arrows with magnification of signature stamp with right side angular light in VSC.



**Figure 8.** Photograph of signature stamp at 61X magnification under VSC.

In Figure 9, we examined all prepared digital rubber-stamp signature samples at higher magnifications at 164X and found that there are no fragmentations/dots present in strokes of the signatures put with signature rubber-stamps and the quality/sharpness is very good because the signatures were scanned in higher DPI (4800×9600) resolutions.



**Figure 9.** Photograph of signature rubber-stamp with 164 X higher magnifications; at these magnifications we observed manufacturing, wear and tear marks, which are indicated by circles.

#### 4. Conclusion

Rubber-stamps, high DPI digital scanners and high quality of printers are easily available in local market for manufacturing of signature rubber-stamp. These rubber-stamps are generally used by company officials, government officers, passport, visa, immigration offices etc. for general purpose. But illegal practice of such rubber-stamps in these activities causes document frauds. When, we apply the signatures with a rubber-stamp prepared by scanning original signatures on high DPI (4800×9600) and apply the blank ballpoint pen on the impressions of the rubber-stamped signatures to create writing pressure marks deliberately, which is impossible to identify with naked eyes that the signatures on document is fake. The rubber-stamped signatures are difficult to detect in normal light, incident light except oblique light, in VSC-6000/HS and higher magnification in VSC. The purpose of this research paper is to alert the forensic scientists, bank employees, insurance, finance companies as well as law & enforcement agencies against such frauds. The higher magnification at 164X in VSC and oblique light with angular positions will help to observe the invisible tremor strokes manufacturing and wear and tear marks around

signature rubber-stamp strokes. The cheques with rubber-stamped signatures were observed with higher magnifications under normal light, ultra violet light, infrared light, spot light, colored filters, angular lights with left and right sides available in Video Spectral Comparator 6000/HS. Under higher resolution magnifications, the indentation marks outside the rubber-stamp ink (deviation at the time of creation of indented marks due to hand tremor, lack of skill, slow overwriting on rubber-stamped strokes, improper support while creating marks or negligence) are visible on the same side of the rubber-stamped signatures. Different types of indented marks are visible on the same side of the rubber-stamped signatures during examination. But in genuine cases these indentation, pressure and flow of writing doesn't break. However, genuine tremors in writing may exist due to some physical incapability of writer. Such cases cannot escape from an experienced eye.

### **5. Prevention and suggestions**

- (i) The manufacturing of rubber-stamps of signatures may be controlled by law.
- (ii) Government should control on such rubber-stamps vendors and only registered vendors can be eligible to do such practices. Customer records like mobile numbers; address etc. should be maintained by the vendor.
- (iii) All the customers' details should be sent by vender to nearest police stations/enforcement agencies monthly for the purpose of records.

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