

REVIEW ON RESTORATION

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ABSTRACT

Restoration is basically a technique to decipher the contents which were hidden by any person to hide any evidence. **Forensic** scientists can use physical and chemical techniques to **restore** or enhance altered characters. And then they will apply chemical reagents, typically acids, to etch the metal until the number is restored. Various techniques have been prevailed in order to decipher these marks but it depends on the type of surface on which it is present.

KEYWORDS: Restoration, Surface

INTRODUCTION

Identification marks or imprints are engraved on a scope of parts what's more, things. Nonetheless, the criminal crew will attempt to expel these distinguishing proof checks either to maintain a strategic distance from relationship with the thing (e.g. guns) or to create a false distinguishing proof stamp for forward deal (e.g. VIN cloning of vehicles). The strategies utilized incorporate documenting, crushing, over-stamping, boring, welding, and so on [1]. Measurable examination can, in any case, recoup the eradicated check in a few conditions, enabling the wellspring of the thing to be followed. Recuperation relies upon various issues, not slightest being the material substrate and the method initially utilized for engraving. Pass on stamping is most normal, in spite of the fact that move squeezing and decorating can likewise be utilized to deliver an engraving on the surface of the substrate. As of late laser scratching has been produced, also, different strategies, for example, hot stamping; etching and cement names are additionally utilized. Present day propels in naming imply that smaller scale chipping or RFD inserts might be utilized later on for exceptional ID, however present and memorable practice has transcendently beyond words[2]. Various things can be restored by using different techniques. Marks present on the different surfaces i.e on steel marks, firearms, aluminium –silicon alloy surfaces, restoration of erased serial numbers on metal plates etc. Techniques that are different etching methods are used for development of these marks but the use of reagents depends on the surface on which the mark is present. Metallographic etching techniques are extensively applied in forensic science laboratories to recover obliterated serial numbers on the chassis and engine of a stolen motor vehicle, or a firearm involved in a crime [3-5] These identifying marks are removed from the metal components by mechanical means such as grinding or filing in order to prevent their identity.

Visualization of the erased numbers provides important forensic evidence during criminal investigations. Over the past many years a large number of techniques using chemical etchants were developed empirically for many metals and alloys. The mechanical inhomogeneities in a metal or an alloy that were introduced during stamping/ engraving a number are revealed during etching because they react at inherently different rates with the reagents. This results in the manifestation of the obliterated number. Chemical etching of specimens is a straightforward, simple procedure that is easily mastered [6].

Methods Used to Obliterate Identification Marks

1 Filing or grinding- The first number would have been recorded or ground with a power grinder pursued by cleaning and after that over stamping with another number.

2 Peening-This includes pounding the surface with a round punch to conceal the number.

3 Over stamping-Here another number is just stamped over the old. For numbers with bended surface dominance of '8' or '4' numbers ought to be treated with doubt.es i.e. 2,3,5,6,9 and 0, the stamp 8 is the one regularly picked. For numbers with straight surfaces i.e. 1 and 7, the stamp 4 is the conspicuous decision. Sequential numbers with suspicion.

4 Centre punching-The surface bearing number is demolished with a pointed punch.

5 Substitution- Substitution of an iron plate with a new number over the original surface by pasting or welding.

6 Welding- Heating the surface with either an oxy-acetylene welder or an arc -welder until the metal flows.

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7 Drilling- It removes the number and the surrounding metal with a drill. The cavity is usually filled up with either lead solder or welding material.

8 Occasionally an original finish would be given to a previous obliterated number surface.

- There is a procedure which has to be followed while examine pr restoring marks from several surfaces. This is:

Preliminary examination-Look at the metal surface subsequent to cleaning oil and soil away, utilizing acetone. Look at the surface with a hand magnifier and see whether any eradication has occurred whatsoever. Search for any unsettling influence in the example at the foundation. This sample will be available either as processed imprints caused by granulating the surface before stamping the sequential numbers, or cast marks delivered amid the assembling procedure. On the off chance that it is bothered, suspect deletion. Regardless of whether no deletion is seen, evacuate the paint over a wide around the surface to check whether the bit conveying the case number was expelled by cutting and substitute for it by welding or gluing a metal plate with

another number⁴. Evacuate the glued plate assuming any, from the first surface by utilizing trifluoroethanol, subsequent to recording the first appearance. Evacuate the welded plate as well. Look at the lower surface for any devastated imprints. Note how the stamp has been eradicated and whether it has been repaired after deletion. Check whether any digits or parts of digits are obvious. Note these down. Inspect the surface via deliberately balanced enlightenment ideally angled lighting to see the deleted number. For photography, utilize a single light to strike the surface bearing the sequential number at a low point. Take a few exposures, the light being moved in every moment to strike the surface from an alternate position. Utilize process film. This strategy helps to drawing out the black out sequential numbers.

Preparation of surface

- (I) clean the surface utilizing ideally benzene or acetone to free it from oil or paint. Solvents, for example, fuel, business paint remover or 50/50 blend of $\text{CH}_3)_2\text{CO}$ and chloroform may likewise be utilized. To help the dissolvable a delicate toothbrush ought to be utilized to unstick stores from the stamped surface.

SURAFCES AND MAETHOD OF RESTORATION:

SURFACE	REAGENT USED	METHOD	RESULT
Aluminium – silicon alloy surface	Etching reagent 1	The two solutions were swabbed alternately on the obliterated surfaces, first, with NaOH for 3min and then with HNO ₃ for 1 min. Acetone swabbing was applied between the two reagents.	The restoration presented good contrast and also was reproducible.[7]
	Ethching reagent 2	The solution was applied continuously until the marks fully recovered.	Marks appeared in white color as long as the reagent was present on the surface and not dried up. The restorations were reproducible.[7][9][10][11]
	Etching reagent 3	First 1 N NaOH was applied by swabbing for 3 min, followed by 0.1M HgCl in 0.1M HCl for approximately 2min	Marks appeared with poor contrast and sensitivity and disappeared on further swabbing. Reproducibility was fair.[12][13]
	Etching reagent 4	The reagent was swabbed continuously until the marks	Both contrast and sensitivity were poor. Reproducibility was fair.[14][15]

		appeared.	
	Etching reagent 5	The specimen was immersed overnight.	Marks appeared in poor contrast. However, it was reproducible.[16][17]
	Etching reagent 6	Swabbing	No restoration was possible even after several repetitions.[18]
	Etching reagent 7	The two solutions were applied alternately by swabbing first, with 60% HCl for 2 min and then with 40% NaOH for the same period	No marks were recovered even after several repetitions.[19][20]
	Etching reagent 8	Swabbing	No marks were recovered even after several repetitions.[7][11]
	Etching reagent 9	(a) Thereagentwasappliedbyswabb ingonthe surfaceeraseduptothedepthofengra ving.The depositedcopperwasremovedbysw abbingwith 50%HNO ₃ (b) Specimenswerealsoimmersedf or5–10s.The reactionwasvigorous.The surfacew asrinsedwith 50% HNO ₃	Nomarkswererecoveredeitherbyswabbi ngorimmersion method.[21]
STEEL COMPONE NETS	Metallogra phic reagent 1	Dissolve copper sulphate in water, slowly add concentrated NH ₄ OH, then slowly add the concentrated HCl. Mix these solutions in ventilated hood	Quite distinct and permanent.[21]
	Metallogra phic reagent 2	Dissolve cupric chloride in water, then combine ethyl alcohol and add acid slowly to the solution	The marks could be inspected even after 1 month[22]
	Metallogra phic reagent 3	Dissolve cupric chloride in water and add acid slowly to the solution	Quite distinct and permanent[23]
	Metallogra phic reagent 4	Dissolve cupric chloride in water, then combine with ethanol and add acid slowly to the solution	Faint and transient[24]
	Metallogra phic reagent 5	Dissolve ferric chloride in water and add acid slowly to the solution	Faint and transient[25]
	Metallogra phic reagent 6	Dissolve cupric ammonium chloride and ferric chloride separately in water, then combine and add acid slowly to the solution.	Faint and transient[26]
	Metallogra phic reagent 7	Add nitric acid slowly to the water	Faint and transient[26]
	Metallogra phic	Dissolve chromic acid in water	- [26]

	reagent 8		
ERASED SERIAL NUMBERS ON METAL PLATES	Etching reagent 1	Reagent was applied on obliterated surface by swabbing method	No marks were recovered even after several repetitions
	Etching reagent 2	Reagent was applied on obliterated surface by swabbing method	No marks were recovered even after several repetitions.
	Etching reagent 3	The two solution was applied alternately by swabbing first, with ferric chloride solution for 10 min and then 25% HNO ₃ for 2 min.	Marks appear in poor contrast. Reproducibility was poor
	Etching reagent 4	The solution was applied continuously until the marks fully recovered.	Marks appeared in fair contrast. Reproducibility was fair.
	Etching reagent 5	The specimen was immersed overnight.	The restoration presented good contrast and also was reproducible
	Etching reagent 6	The three solutions were swabbed alternatively on the obliterated surfaces, first with phosphoric acid for 3 min then with conc. HCl for 5 min and then with NaOH	No marks were recovered even after several repetitions.
	Etching reagent 7	The two solutions were swabbed alternately on the obliterated surfaces, first with solution 1 and then HNO ₃ . Acetone swabbing was applied between the two reagents.	Marks appear in poor contrast. Reproducibility was poor.
	Etching reagent 8	Swabbing method	Marks appear in poor contrast. Reproducibility was poor.
	Etching reagent 9	Reagent was applied on obliterated surface by swabbing method	No marks were recovered even after several repetitions.
	Etching reagent 10	Reagent was applied on obliterated surface by swabbing method	Marks appear in fair contrast. Reproducibility was fair.

VARIOUS OTHER SURFACES FROM WHERE MARKS CAN BE RESTORED ARE:

WOOD: Numerous wooden articles are stamped with distinguishing markings which might be eradicated by cutting, documenting or the utilization of rough. Given the territory underneath the introduction has been aggravated by the first punching, decipherable outcomes might be gotten. Play a stream of steam onto the erased surface. The steam mollifies the wood and causes the strands which were bowed amid punching the number to spring back and the broken filaments to swell. Where the stamp has been, the wood presently extends over the surface and the check can be deciphered. Pretreat with an solution of caustic soda or potash for hard woods, such as are utilized for instrument handle. This softens the wood and quickens the treatment.

LEATHER :(I) Try all strategies for improvement given underneath, as the treatment of leather is exact. Clean the surface with cotton-fleece swab absorbed chloroform, and look at under bright light. This works honorably when the decorated letters have been loaded up with an oil paint. The oils are conveyed to the surface by the chloroform and blueprint the letters as a brilliant fluorescence.

(ii) Swab the surface with cotton wool absorbed 2N caustic soda solutions. The loose disturbed surface ingests the arrangement, mollifies and obscures. The compressed leather, which has been emblazoned, does not retain the arrangement so rapidly. This differential ingestion empowers the deleted check to be deciphered.

(iii) When the carbon ink has been utilized on the emblazoned number and the equivalent has been soaked into the surface. Clean the surface as above and take an infrared photo. At the point when the ink has been a carbon ink and has soaked into the surface, cleaning along these lines gives a surface which photos as white under infra-red while the hints of carbon ink are shot seriously dark.

RUBBER: Some rubber articles are stamped, and when stamping is erased the presume area can be treated by gently swabbing with petroleum or even on events carbon-disulphide. This last arrangement follows up on elastic quickly and ought to be utilized with caution.

POLYMERS: Various polymers need different method in order to restore the marks from it, some are listed as follows:

Polymer type	Method
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Polyethylene (high density) (PE-HD)	Heat (100°C, 5 min.), swelling with ethanol, light petroleum (40-60)
Styrene acrylonitrile (SAN)	Polishing heat (140°C, 10 min.), swelling with light petroleum (40-60)
Acrylonitrile butadiene styrene (ABS)	Polishing heat (100°C, 10 min.), swelling with light petroleum (40-60)
Polyamide (PA 6)	Polishing heat (150°C, 5 min.), swelling with light petroleum (40-60)
Polyoxymethylene (POM)	Polishing heat (150°C, 30 min.), swelling with light petroleum (80 °C)
Polybutylene terephthalate (PBTP)	Polishing heat (200 °C, 10 minutes)
Polycarbonate (PC-GF)	Swelling with ethanol, ethyl ether, heat (120°C, 5 min.)
Epoxy resin (EP)	Swelling with acetone, formic acid, ethyl acetate, light petroleum (40-60)

METHOD OF RESTORATION OF PAINTED NUMBERS:

1-Take photos the suspected obliterated surfaces previously treating it in any way. Look at the number plate and the vehicle surface at various enlightenments, particularly the slanted one. The wrecked imprints may now and then be unmistakable.

2-Wash away the fresh paint and the new number with chloroform or dioxan. Keep in mind that this activity has its risks in light of the fact that the fundamental paint and the imprints tend to wash away alongside the best layer. Attempt appropriate solvents blends of solvents at some other place and therefore pick the reasonable dissolvable or blend of solvents for application in the obliterated surface

3-Apply the picked solvents in cotton swabs over the paint surface suspected of being obliterated. Hold up till the top layer just swells. Expel this layer precisely by delicate rubbing with cotton. Search for the crushed stamps and record them by photography and point by point notes. Take care that the under layer isn't washed away and expelled alongside top layer. Utilize the above method to find in more than one obliterated marks underneath.

4-X-beam shadowgraph-If the article is portable apply this technique. Most ideal outcomes are the point at which the basic layers are painted with a paint containing overwhelming components, for example, lead, while the top paint is free from such components. With the right introduction the blueprints of crushed imprints can be deciphered.

5-For the situation of number plates where unique sticker number is evacuated or supplanted, attempt specular reflection. Toss an even light on the plate from a point and photo the plate from above. The brilliantly cleaned regions, which have been secured by the lettering, mirror the light specularly far from the camera. The weathered regions diffuse the light to some degree and a portion of this diffused light goes into the camera. Therefore, the lettering seems dark on a light foundation

6-Expose the plate to bright radiations. On the off chance that the territory fluoresces in bright light record the appearance by photography. Photo following the systems of UV fluorescence photography.

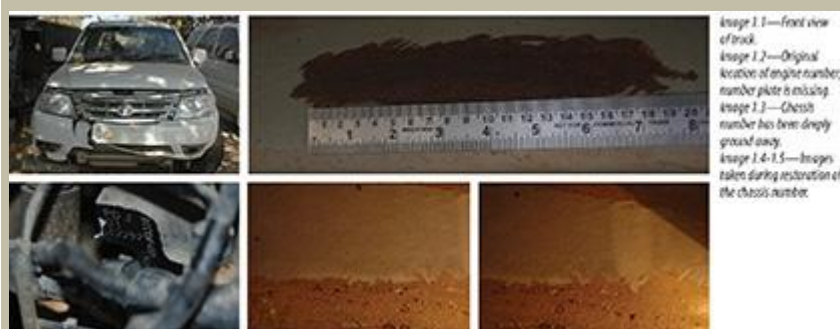
7-A photographic records of the reestablished imprints ought to be made.[28]

CONCLUSION

From this paper it has been concluded that various techniques have been applied to restore the marks present on different surfaces with different composition of the reagents. Various new techniques need to be used to get more accurate results and that too in less time.

CASE STUDY:

Case I: Tata Xenon pickup truck



In this case, the driver of a Tata Xenon pickup truck was stopped by the police and subsequently found to be transporting 500 kg of Doda Chura (poppy straw—the dried, upper portion of the opium poppy, minus the seeds). Our team traveled to the district police station and examined the chassis and engine of the truck. It was evident that grinding and rubbing had been performed in the area of the chassis number. The number plate was missing from the engine. We were able to successfully restore the original numbers of the pickup truck.

The following process is utilized when peening is observed (Images 1.1-1.5): First, prepare the surface using a file to polish and clear the damage caused by the pointed punch. Next, treat the surface with the solution shown in the flow chart for the iron-based chassis. The solution can be applied continuously for about 9 to 12 hours, or over the course of 2 to 3 days for 5 hours per day. Photographs should be taken before and after each step to document the process.

Result

The restored number of the chassis of the Tata Xenon pickup truck (Images 1.4-1.5):

* M A T 4 6 4 2 0 3 C S K 0 2 4 1 0

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