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Inspection and Analysis of High Imitation Machine Engraved Seal Printing Using Inversion Method

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ABSTRACT: In the practical work of identifying the authenticity of document seals and seals, various types of highly imitated seal seals have emerged in recent years, which have the characteristics of multiple imitation methods, low cost, and high difficulty in identification. This poses a huge challenge to the authenticity identification of seal seals and seals. Traditional imitation methods such as using 1) manual carving; 2) Covering and piecing together single words; 3) Photographic plate making; 4) Computer scanning laser engraving [2]; 5) Forgery methods such as printing and copying. Document appraisers must be proficient in the characteristics of various types of high imitation seals in order to distinguish the authenticity of seals, perform outstanding appraisal work, maintain judicial fairness, and protect the legitimate rights and interests of parties involved. The author is based on a case of injection molded high imitation seal seals encountered in practical work. This type of seal imitation method is a new type of forging method, which has the characteristics of injection molded seal production, high simulation degree, and high difficulty in inspection. To address the identification needs of such high imitation seal seals, gypsum powder, silicone, and plastic

raw materials are used to make gypsum models from real seals, By using a silicone [1] and A-B mixed hard glue reverse molding machine to carve ox horn seals and rubber seals, comparing and inspecting the gypsum mold with the real seal, the silicone seal with the rubber seal, the A-B mixed hard glue seal with the ox horn seal, the silicone seal with the A-B mixed hard glue seal, and summarizing the similarities and differences between the silicone and A-B mixed hard glue seal with the real seal, The analysis results can provide a theoretical basis for the inspection of this type of high imitation seal imprint.

KEY WORDS: Gypsum impression; Hard adhesive seal; Silicone seal

PREFACE: At present, the forgery of seal imprints can be divided into direct forgery and indirect forgery. The specific forgery methods include: 1) using manual carving; 2) Spelling together single words; 3) Photographic plate making; 4) Computer scanning laser engraving [2]; 5) Printing replication. The gypsum reverse molding method used in this paper is a direct forging method, and there has been no previous research on the inspection technology of using this method to imitate seal seals. Through multiple experiments, the author summarizes the characteristics of this imitation method and compares it with real seal seals, providing theoretical and practical basis for the inspection of such high imitation seal seals.

1 Materials and Methods

1.1 Materials

1) The hardness is 8.9mp, and the fineness is 1500 mesh gypsum powder; 2) A-B typ e mixed hard adhesive; 3) Silicone; 4) Transparent wide tape; 5) High precision electr onic scale; 6) Machine carved ox horn seal; 7) Machine engraved rubber seal; 8) Pea nut oil.

1.2 Operation method

1) Apply peanut oil to the surface of the ox horn seal and rubber seal for easy demo lding; 2) Wrap transparent tape around the seal frame to drain air; 3) Mix the gypsu m powder to water ratio (3.6:1) evenly, then pour the mold and let it stand. After 30 minutes, the mold can be demolded; 4) Apply peanut oil to the surface of the prepar

ed seal gypsum model, wrap it around the model frame with transparent tape, and dra in the air; 5) Inject silicone and A-B mixed hard adhesive separately; Wait for the glu e to dry and set before demolding.

2 Results and Discussion

1.1 Inspection and analysis of the characteristics of high imitation gypsum impressions (Figure 1).

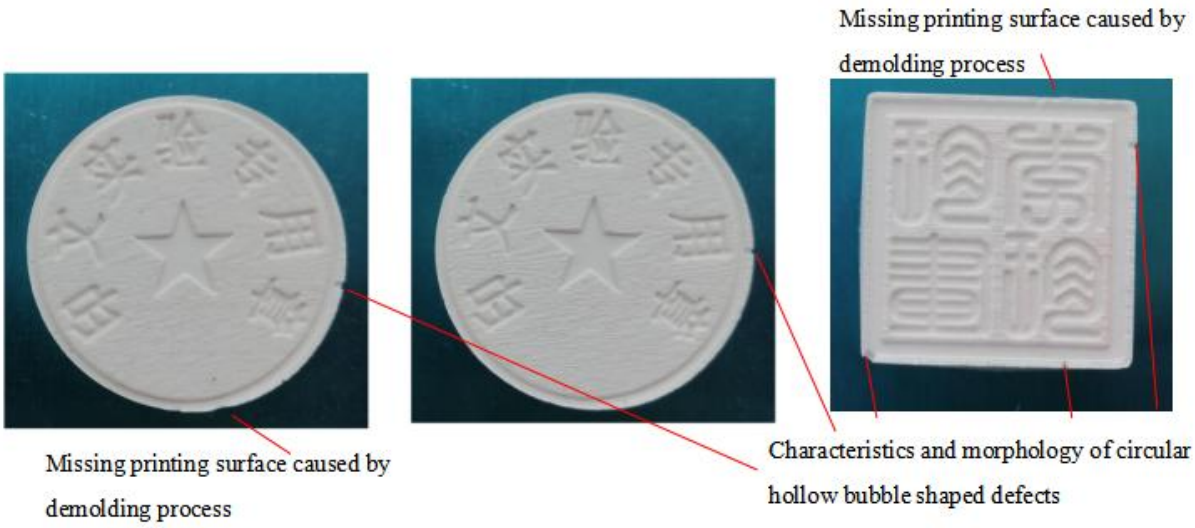

Fig.1 Gypsum impression

Gypsum has a high imitation ability, which can better imitate the specifications, patter ns, text, line shapes, matching ratios, and shading of seals. After multiple imitation ex periments, there have been varying degrees of printing surface defects and defect char acteristics. As shown in Figure 1, the main reason for the occurrence of printing surfa ce defects and defects in stone paste seals is the formation of bubbles during the mix ing process of gypsum powder and water, Although the generation of this type of bub ble has randomness in position, it appears as a circular hollow shape in shape, with a high frequency of occurrence and strong feature stability, which is an essential featur e of high imitation gypsum molds. Other reasons for the occurrence: 1) uneven distrib ution of gypsum slurry injection and the formation of voids; 2) The gypsum slurry is not completely dry; 3) Printing surface defects caused during the demolding process; 4) The transparent tape does not drain air during the winding process, resulting in wri nkles; 5) Impurities are mixed during the mixing process of gypsum powder and wate r. The above reasons manifest as diversity in the form of seal defects and defects, wit

h random occurrences and unstable characteristics, making it impossible to further distinguish between high imitation methods in the case. In addition, gypsum also has carving function, and counterfeiters can perform secondary carving processing based on the real seal, which is easy to leave new imprint marks (such as knife scratches).

1.2 Analysis of the characteristics of high imitation silicone seals (Figure 2).

Fig.2 Silicone seal

Silicone has strong shaping ability and good inking ability, which can effectively replicate the specifications, pattern, text, line matching ratio, and shading of seals. After multiple imitation experiments, there have been strokes sticking, varying degrees of printing surface defects, and defect features, as shown in Figure (2), The main reason why silicone seals are prone to defects and defects on the printing surface is the generation of bubbles during the mixing process of silicone and curing agent, as well as the existence of defects and defects on the printing surface during the production of gypsum molds. The bubbles generated during the mixing process of silicone and curing agent have randomness in position and form a circular hollow shape, but the frequency of occurrence is extremely high and the characteristic stability is strong, which is the essential feature of highly imitated silicone seals. Defects and printing surface defects

that already exist during the production of gypsum molds, but in each subsequent imit ation, defects and printing surface defects with the same shape and position appear, w hich are convex in shape and have strong feature stability. The above features can be used to further distinguish high imitation methods in the prosecution. Other reasons f or printing surface defects and defects: 1) The silicone is not completely dry; 2) Dam aged printing surface during demolding process; 3) Impurities mixed during silicone in jection process; 4) The transparent tape did not drain air or produce wrinkles during t he winding process. The above reasons manifest as diversity in the form of seal defec ts and defects, with random occurrences and unstable characteristics. The reasons for s troke adhesion are: 1) the physical and chemical properties of silicone, poor flowabilit y, 2) uneven distribution of silicone injection, and small stroke gaps. In actual cases, stroke adhesion, varying degrees of printing surface defects, and defect morphology ch aracteristics can be used to analyze the causes and distinguish high imitation methods.

1.3 Analysis of the Characteristics of High Imitation A-B Mixed Hard Adhesive Seals (Figure 3).

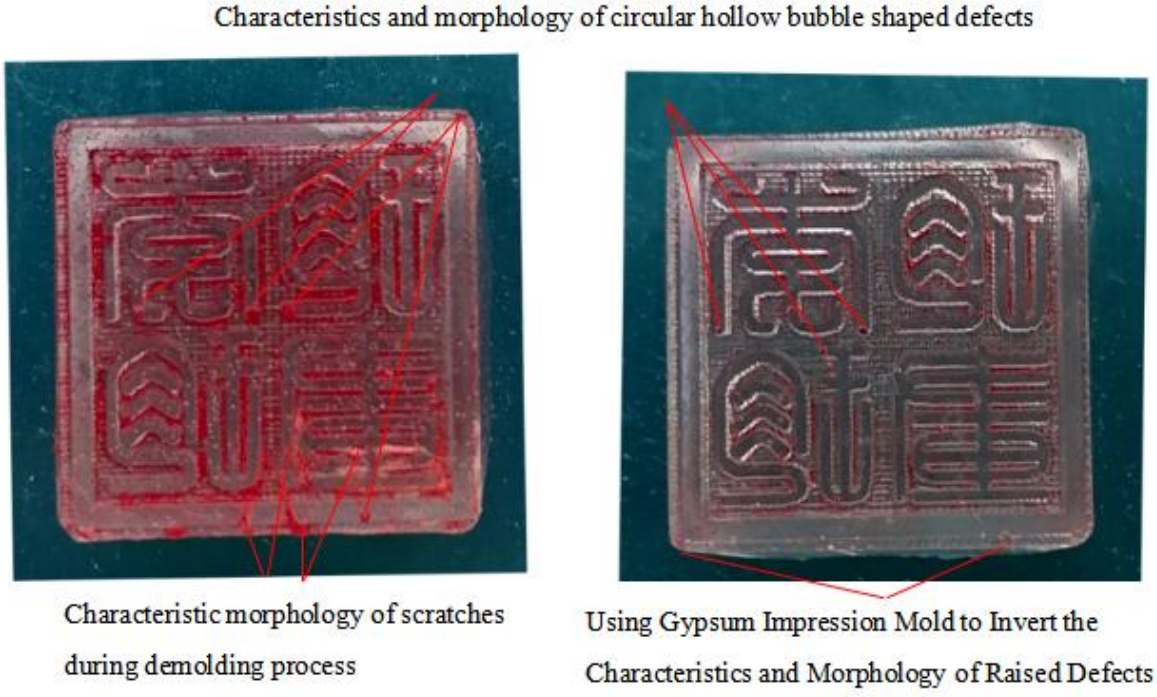

Fig.3A-B mixed hard rubber seal

The A-B mixed hard adhesive has strong shaping ability and poor inking ability, and can effectively imitate the specifications, patterns, text, line shapes, matching ratios, and shading of seals. After multiple imitation experiments, there have been varying degrees of printing

surface defects and defect features, as shown in Figure (3), The main reason why A-B mixed hard rubber seals are prone to printing surface defects and defects is that bubbles are generated during the mixing process of A and B adhesives, and defects and printing surface defects already exist during the production of gypsum molds. The bubbles generated during the mixing process of A and B adhesives have a random position and form a circular hollow shape, with high frequency and strong feature stability, which is the essential feature of high imitation hard rubber seals. Defects and printing surface defects that already exist during the production of gypsum molds, but in each subsequent imitation, defects and printing surface defects with the same shape and position appear, which are convex in shape and have strong feature stability. The above features can be used to further distinguish high imitation methods in the prosecution. Other reasons for printing surface defects and defects: 1) uneven distribution of A-B mixed hard glue during injection; 2) The A-B mixed hard adhesive is not completely dry; 3) Impurities are mixed in the mixing and injection processes of A and B mixed hard adhesives; 4) The transparent tape did not drain air or produce wrinkles during the winding process. The above reasons manifest as diversity in the form of seal defects and defects, with random occurrences and unstable characteristics. During the demolding process of A-B mixed hard adhesive, it is easy to produce printing surface defects and scratches during warm water immersion and washing, with a high frequency of occurrence. In actual cases, different degrees of printing surface defects and defect morphology characteristics can be utilized to analyze the causes and distinguish high imitation methods.

1.4 Comparison test between gypsum impression and real seal (Figure 4).

Fig.4 Rubber seal (left) gypsum impression (right)　　Ox horn seal (left) gypsum impression (right)

Compare the gypsum mold with the real seal, and the two overlap and match. In terms of seal specifications, patterns, text, line shape, matching ratio, shading, and border features, there are certain differences in the distribution of ink marks on the printing surface. Gypsum molds are prone to defects and defects on the printing surface, and the reasons are as follows: 1) Bubbles

are generated during the mixing process of gypsum powder and water; 2) Uneven distribution of gypsum slurry injection and the formation of voids; 3) The gypsum slurry is not completely dry; 4) Printing surface defects caused during the demolding process; 5) The transparent tape does not drain air during the winding process, resulting in wrinkles; 6) Impurities are mixed during the mixing process of gypsum powder and water.

1.5 Comparative inspection of rubber seal imprints and inverted silicone seal imprints (Figure 5).

Fig.5 Rubber seal (top left) Silicone stamp (top right)/ Rubber stamp (bottom left) Silicone stamp (bottom right)

Compare the rubber seal imprint with the inverted silicone seal imprint, and find that the two overlap and match. There are similarities in the seal material, as well as in the seal specifications, pattern, text, line matching ratio, shading, border, and inking characteristics. There are differences in the print surface defect, font stroke shape, and print surface ink distribution (defect) characteristics. The reasons are as follows: 1) Defects and print surface defects already exist when making gypsum molds; 2) Bubbles are generated during the stirring process of silica gel; 3) The distribution of silicone injection is uneven, with some small strokes sticking; 4) Silicone not completely dried; 5) Damaged printing surface during demolding process; 6) Impurities mixed during silicone injection process; 7) The transparent

tape did not drain air or produce wrinkles during the winding process.

1.6 Comparative inspection of ox horn seal printing and inverted A-B mixed hard rubber seal printing (Figure 6).

Fig.6 Ox Horn Seal (top left) Inverted A-B Mixed Hard Adhesive Seal (top right)/ Ox Horn Seal Seal (bottom left) A-B Mixed Hard Adhesive Seal (bottom right)

The comparison between the Niujiao seal and the inverted A-B mixed hard rubber seal shows that the overlap test is consistent. There is similarity in the hardness of the seal material, the matching ratio of the seal specification, pattern, text, and line, the shading, border, and inking characteristics are consistent. There are differences in the printing surface defect, font stroke shape, and ink distribution (defect) characteristics. The reasons are as follows: 1) Defects and surface defects already exist during the production of gypsum molds; 2) A and B mixed hard adhesives produce bubbles during the stirring process; 3) Uneven distribution of A-B mixed hard adhesive during injection; 4) The A-B mixed hard adhesive is not completely dry; 5) Defects occur during demolding, soaking in warm water, and rinsing; 6) Impurities are mixed in the mixing and injection processes of A and B mixed hard adhesives; 7) The transparent tape did not drain air or produce wrinkles during the winding process.

1.7 Comparative inspection of inverted silicone type and inverted A-B mixed hard rubber seal imprint (Figure 7).

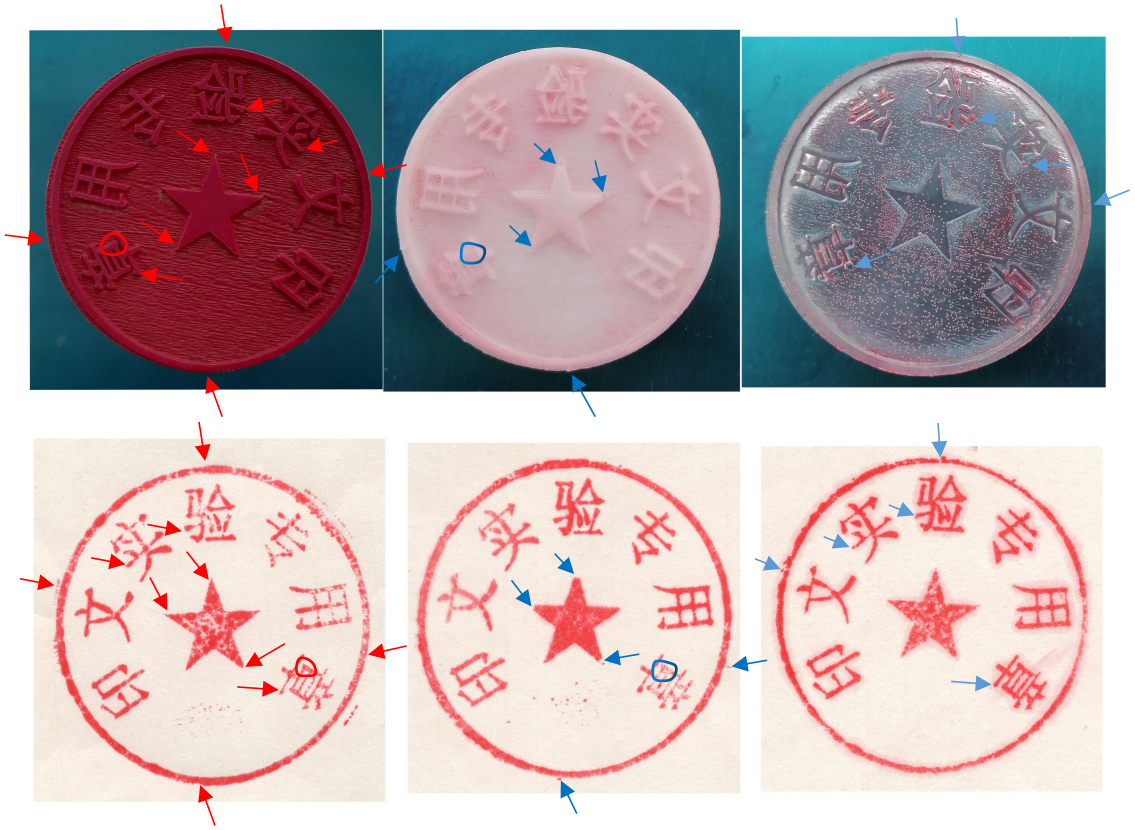

Fig.7 Rubber seal (top left) Inverted silicone seal (top center) Inverted A-B mixed hard rubber seal (top right)/Rubber seal (bottom left) Inverted silicone seal (bottom center) Inverted A-B mixed hard rubber seal (bottom right)

The inverted silicone type and inverted A-B mixed type hard rubber seal imprints are compared with the real rubber seal imprints, and the differences are as follows: 1) The material is different, and the solidified silicone is a soft material with strong inking ability. During the stamping process, it is more prone to the appearance of shading features, and it has similarities in inking ability with soft materials such as rubber and wood seals. After solidification, A-B mixed hard adhesive becomes a hard material with poor inking performance, making it difficult to exhibit shading features during the printing process. It has similarities in inking performance with hard material seals, such as ox horns, stones, metals, etc; 2) The quality of imitation is different, but the quality of silicone imitation is slightly poor. The overall round strokes of the font are smooth, and small strokes are prone to adhesion or blurring. The A-B mixed hard glue imitation has high quality, strong fluidity, and the shape and shading of the font strokes are closer to the real seal, making it less likely to cause adhesion and blurring on small strokes. 3) The demolding process is different. Silicone can completely dry out i

n about 30 minutes and can be demoulded directly. The operation is simple and does not damage the gypsum seal. A-B mixed hard glue can dry out for 1-2 days and has strong adhesion. After complete solidification, it needs to be soaked in warm water until the gypsum softens to demould. During the demolding process, it is easy to damage the gypsum seal. After demolding, a small amount of gypsum slurry will adhere to the surface of the hard glue seal, which needs to be manually removed, making it easy to generate new scratches on the printing surface. 4) The price is different, and the price of silicone is higher than that of A-B mixed hard adhesive. Similarity: Both belong to a viscous liquid state before solidification, and are prone to generating bubbles during the stirring process, both possessing strong shaping ability.

3 Conclusion

If the suspect has the opportunity to contact the original seal of the party concerned, such as the seal carver, seal keeper, and the person who can use his/her authority to apply for the seal, the gypsum seal can only reflect the print characteristics of the real seal in a certain period of time, and the phased characteristics of the real seal in the later use process cannot be copied. By using silicone type and A-B mixed hard glue for reverse molding, the quality of silicone imitation is slightly inferior to A-B mixed hard glue, and both can overlap with the real seal printing. There is a high degree of similarity in seal specifications, pattern, text, line matching ratio, shading, and border features. Gypsum impression, silicone type, and A-B mixed hard glue are all prone to producing bubble like defect features. This feature has a high frequency of occurrence, strong stability, and is an essential feature that can be used to judge the authenticity of printing and distinguish high imitation methods. The printing surface defects, defects, and differences in font stroke morphology that are easily caused during the molding and demolding process have diversity in morphology. In the investigation, it is necessary to distinguish this difference from the attachment of the real printing text and the wear characteristics during use, and further analyze the essential characteristics of bubble shaped defects generated by the reverse molding method. Using a gypsum molding machine to engrave seals, the production time of gypsum molds is short, and they can be carved and reused. The operation is simple, the cost of copying is extremely low, the harm is high, and the inspection is difficult. Therefore, in the process of

investigating cases, it is necessary to combine the characteristics of the reverse moldin g method and various types of high imitation seal seals, collect and test samples for s imultaneous stamping, use the method of eliminating the diachronic characteristics of s eal seals, and comprehensively analyze the case.

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