Silverprint Emulsion SE1
Silver gelatin photo emulsion
Light sensitive product • Open under red or orange safelight conditions only • Store below 10°C, do not freeze • Caution — see warning box

With the reduction of variety in manufactured photographic paper, the Silverprint emulsions offer an alternative but straightforward means to printing, not only on paper but on an extremely wide range of materials from fabric to glass. They are high-quality modern black and white photographic emulsions, as normally used by photographic paper manufacturers to coat paper.

The emulsions are supplied in light-tight bottles as solid gelatin, which melts when the bottle is placed in hot water above 40°C. (Although to give time to coat it is best to heat the material to around 60°C.) Once liquified, the emulsion is applied by one of a variety of coating techniques and allowed to dry before being exposed. It is then processed in essentially the same way as a conventional manufactured paper.

These instructions offer a brief account of basic technique. For more extensive discussion and guidance see *Silver Gelatin, A User's Guide to Liquid Photographic Emulsion*, available direct from Silverprint.

SE1 Emulsion

A normal contrast bromide emulsion with a high silver content and a good concentration of high bloom gelatin which aids robustness in use, and gives good adhesion to a variety of surfaces.

Warning

This product contains 0.5% phenol as bacteriocide. Avoid prolonged skin contact. Wash with hot water. In case of eye contact rinse with cold water and seek medical advice.

[1] Storage, Shelf-life and Safelighting

When not being used the emulsion should be stored below 10°C, but not frozen. As with other photographic materials, age increases fog level. If this becomes a problem, the emulsion may still be usable with the addition of an anti-foggant such as Rayco R42.

Each re-melting from the solid state will reduce the viscosity of the gelatin and increase fog level. To minimise this effect, especially if a large quantity is to be used over a fairly long period of time, the emulsion can be melted down and divided into separate small containers which are then used as needed. Opaque black tubs are ideal, but non-opaque containers are usable if the emulsion is first put in opaque plastic bags of the kind used for photographic papers.

It is worthwhile to test fog level in a given darkroom for a given batch of emulsion, to see whether this is likely to be a problem. This may be done by coating a piece of fibre-based black and white paper that has been fixed, carefully, washed and dried. The paper should be left under safelight conditions for five minutes or so before being developed and fixed normally. If fog appears, it may have arisen from two possible sources. The first is the darkroom. This can be tested by coating and processing in complete darkness.

The darkroom used must be absolutely light-tight, since the time involved for handling the emulsion is likely to be close to its maximum safelight duration. Likewise, darker red rather than orange safelights will give longer safe handling times. Room and processing solution temperatures should be below 25 degrees.

Having eliminated the effects of the darkroom environment the emulsion itself can be tested, increasing the anti-foggant until fogging is suppressed. If significant additions of anti-foggant are needed the emulsion should be replaced.

[2] Base Selection

It's a good idea to work initially with a good quality watercolour paper in order to develop competence and later, if desired, move to other surfaces.

Although almost any paper can be coated two factors make watercolour paper a good starting point. First, watercolour paper is designed to take liquids and is thus well-suited to the application of emulsion. Second, it is likely to be of higher quality, notably acid-free, and is therefore better suited to producing a stable, permanent image.

Normally paper will require no special preparation but a particularly absorbent stock, like other absorbent materials, may require gelatin size. A ready-made preparation is the Silverprint Hardening and Subbing solution.

Papers are available in a variety of surfaces. In general, hot-pressed, very smooth papers will show the highest resolution but may be unforgiving of errors in coating — whilst very heavily textured papers can have a tendency to allow pools of emulsion to form on their surface, resulting in blotchiness. A heavier weight paper (say 300 gsm) will be more robust in processing, and distort less as it dries.

Fabric

Natural fabrics are most suitable since their fibres provide a better texture for the emulsion to adhere to. Muslin, linen, cotton and silk are usually supplied in a form that cannot contaminate the emulsion, but other fabrics should be washed extensively to remove residual chemical content left from manufacture. Pure soap flakes should be used. Some fabrics, e.g. canvas, require the use of an oil-based primer if maximum total range and sharpness is desired and others may produce a better image if they are primed.

Glass, Ceramics, Stone, Metal, Wood *etc.*

In general the key considerations are —

Is the material too smooth to accept emulsion readily?
With glass or enamelware, for instance, a gelatin subbing layer may be helpful.

Is the material too porous and therefore likely to soak up both the emulsion and processing chemicals?
Examples: unglazed ceramics, some stone. Again the antidote is a subbing layer.

Does the material contain chemical residues that will fog or otherwise interfere with the emulsion?
— e.g. with wood and many metals. In this case a lacquer or primer application is recommended.

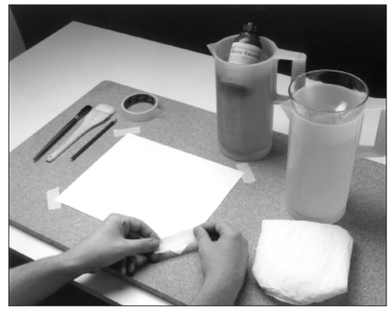
All surfaces should be carefully cleaned.

[3] Emulsion Coating

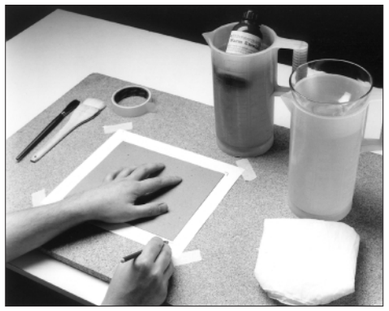
A wide variety of coating methods are possible and the best approach is to establish one that works for you. Only a few methods are mentioned here and '*Silver Gelatin*' should be consulted for further techniques.

Brush coating

Brush coating is perhaps the most versatile; it will work well on paper as well as a number of other materials. Brushes must not have metal parts that will come into contact with the emulsion. Chinese-made goat's hair Jiaban brushes are an economical and suitable option, but like any new brush should be washed carefully before use to remove loose hairs. The surface should be brushed smoothly in a sequence of vertical followed by horizontal strokes. If the emulsion continues to be worked to the point where it starts to gel, bubbles will tend to burst or be swept aside. Since vertical brush stroke marks are more obvious than horizontal ones care should be taken to finish with horizontal strokes. A heavy deposit of emulsion at the point where the brush is lifted from the work should be avoided, as this will prove difficult to fix adequately and will be prone to staining.



C. Paper positioned and held down to prevent movement



D. The paper is carefully corner-marked to show the area coated with emulsion

A. Emulsion held in a bowl over a jug of hot water.

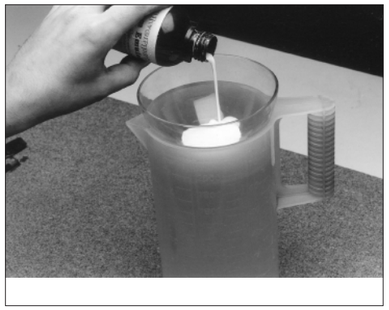
E. Emulsion being applied with vertical strokes

B. Producing test strips using the same materials and coating techniques as the full sheets

... and finished with horizontal strokes, which are less uneven to the eye in the finished print

Dip Coating

If you have sufficient emulsion and a number of sheets of paper are to be coated, dip coating can be very effective. To avoid using excessive quantities of emulsion, it should be pooled at the end of a tilted developing dish. The dish itself should be stood in a larger container of hot water that will act as a water jacket to keep the emulsion fluid. The paper is then held at each end in a 'U' shape. One end is allowed to just touch the emulsion and it is then pulled across the surface in a continuous movement keeping the upper side of the paper dry.



Dip coating paper by touching one side down onto the emulsion surface.

Spraying

Spraying will work on many surfaces and is especially suitable for three-dimensional objects. It's a method worth trying with any surface proving difficult via other techniques. It has its own special difficulties and should therefore not be the first choice for coating small flat areas where other effective approaches are available.

The spray nozzle used should not have metal parts that could cause contamination. The emulsion is best diluted with water or a considerable amount of pure alcohol e.g. clear methylated spirit. This produces a finer mist of droplets on spraying and also helps them to flow together on the base to form a *[turn over]*

Spraying using a rechargeable aerosol.

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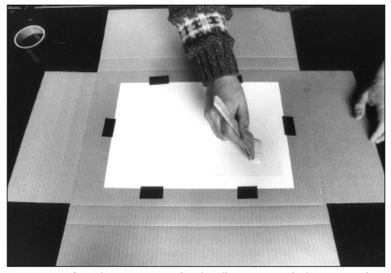
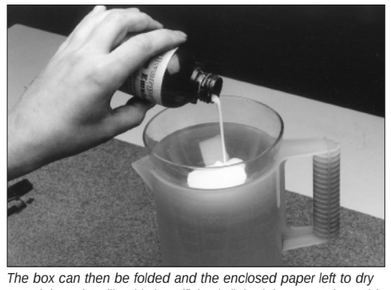
continuous coating. Because of its rapid evaporation, alcohol aids fast and even setting of the emulsion and is therefore a better choice than water. A suggested mixture is 1litre of emulsion to 500ml of alcohol. The alcohol should be added slowly, stirring constantly to avoid the gelatin curdling. When spraying, a vapour mask containing an organic vapour cartridge is essential, as is good ventilation and great care with fire precautions.

If unevenness in coating is experienced — whether spraying or employing other techniques — adding wetting agent up to as much as 30% by volume may yield improvements, as may the Silverprint Subbing Solution and Emulsion Hardener. A second coating after drying may help attain a blemish-free result with maximum blacks. For reasons of economy or to create a paler image, perhaps for hand-colouring, dilute the emulsion by up to 1 part emulsion to 2 parts water.

Once coated, the emulsion should be air dried. Gentle heat from a hair dryer or fan heater will speed the process. Care should be taken at this stage to ensure that the emulsion is not fogged by extended exposure to safelight. If coated material is to be allowed to dry for an extended period then this should take place in complete darkness. A good supply of photographic paper boxes are well suited to storing drying, or dry, coated paper.



One way of setting up a 'production line'; paper being coated after attaching to a folding box. A number of boxes can be stacked after coating.



The box can then be folded and the enclosed paper left to dry overnight. A box like this is sufficiently light-tight to stand considerable safelight exposure.

Spillages of emulsion and utensils used for handling it are best cleaned with very hot water.

[4] Printing & Processing

Printing and processing is in most respects exactly the same as with a fibre-based paper of a fixed medium contrast. After exposure the emulsion is passed through a developer followed by a stop bath and then a fix. It is a good idea to make test coatings on the material chosen and to use these to determine correct exposure. Allowance should be made for considerable dry-down and ideally tests should be carried through to the dry stage to determine to what degree exposure compensation must be made for this. As with a manufactured graded paper, contrast may be reduced by using a soft -working print developer or by flashing. Different enlarger light sources may also be used to alter contrast. A condenser head provides higher contrast than one that uses opal acrylic as a diffuser — such as a colour head or a cold-cathode.

Standard developers such as Agfa Neutol, Kodak Dektol or Ilford P.Q. Universal work well. Agfa Neutol W.A. is particularly suited for warmer-toned development and to give a result suitable for subsequent toning. Development should be followed by a stop bath and a standard ammonium thiosulphate fix such as Agfa Agefix, Kodak Polymax or Ilford Hypam. The addition of a hardener to the fix is recommended to aid robustness in wet handling.

After fixing, the coated material should be washed with greater care than a conventional fibre-based print, particularly if the material is likely to have absorbed a lot of processing chemistry. It is generally advisable to also use a hypo-clearing bath.

Good washing means two main things; gentle agitation and regular replacement of water. Higher temperatures are more efficient at washing out the fix but must not rise above 25 degrees. Very cold water is extremely inefficient with approximately a doubling of necessary wash time from 20 degrees to 10 degrees. If wash temperature drops to 10 degrees or below, hypo-clearing becomes mandatory to avoid staining and to achieve permanence. It is worth noting that complete changes of still water can wash as well as constant flow. This may be a more convenient process, depending upon the surface coated, and the cold water temperature. The emulsion will tone normally and no special technique need be applied, though as always when the emulsion is wet, care should be taken to avoid mechanical damage.

[5] Finishing and Permanence

Do not use any form of drying that involves contact with the wet emulsion. Heated canvas apron driers are not an option even when paper has been coated. Fibreglass mesh is a useful base for drying coated paper and may be obtained cut from a roll and made up into screens, or screens may be bought ready-made. As with coating gentle heat from a hair dryer or fan may be employed to hasten the process. Coated paper will not dry entirely flat, with thinner papers particularly prone to buckling and curling. Prints can be flattened between card under weights or in a dry mounting press on a low heat setting.

There are bound to be some blemishes in the final result and these may be readily re-touched by Spot-Tone retouching dyes, watercolours and so forth. Large gaps in the emulsion may require the application of gelatin before adding dyes. Coated materials will also often be very suitable for hand colouring and other illustrative techniques.

Archival considerations

Producing photographic work by coating one's own material lengthens the odds against a high life expectancy. In certain situations this may not be relevant but if a maximum life duration is required problems come from two main sources: The quality of the bond between the emulsion and the base and the quality of the processing, particularly the washing.

In the latter area complications may arise because one is working with an indeterminate thickness of emulsion, which may not fix completely, or because a porous base may pose difficulties in washing efficiently. Such problems may make themselves manifest through staining and partial or complete separation of the emulsion from its base.

High degrees of light and humidity will greatly accelerate the breakdown of a work and a print that might appear quite stable in moderate temperature may deteriorate rapidly if displayed in sunlight. It is therefore wise to be very wary of attaching a high commercial value to a piece of work made using self-coated emulsion unless one or more of the following apply:

1. The work has been in existence for some time (say two to five years) and has been stored under typical display conditions.

2.You are very confident of your technique, and ability to produce consistent quality.

3. You can make some sort of contract to the satisfaction of both parties if a problem should appear. This should contain clauses to cover the level of illumination to which the work is subjected and other related criteria including temperature.

Archival storage methods are as for fibre-based papers and appropriate reference works should be consulted. The main relevant points are to keep the work away from potentially damaging materials like acidic papers, bare wood or certain plastics; to keep it out of the light as much as possible and to avoid temperature and humidity extremes.

[6] Troubleshooting

1. Shiny specks in the print resembling mica particles are actually small bubbles in the original coating dried down to a tiny light-reflective scale. To prevent, try modifying coating technique, though in general they are fairly easy to retouch. Small **blue specks**, however, are iron particles washed in from corroded iron pipes. Use a water filter, preferably with an in-line cartridge down to five or ten microns.

2. Large bubbles — highly visible. Largest resemble craters with centres devoid of emulsion. Usually visible during coating, should be blown away or touched with a rod immersed in emulsion.

3. **Areas that separate from the base** indicate a weak emulsion bond, insufficient drying — or possibly poor base preparation/ subbing. Overthick emulsion coating will aggravate the problem. Answer: avoid big temperature changes between processing stages. Cool print material more progressively. Use water baths if necessary, when washing. OR: process at lower temperature, chill solutions to 15-20°C OR: increase hardener content. OR: use pre-hardener (formula "SH1" listed in '*Silver Gelatin'*).

Note: some rebonding may occur, give up hope only after the work has dried.

Note: **Frilling** around the edges, usually found on smooth glass or ceramics, is a special case of base separation at the points of least resistance. Deal with as above.

4. Reticulation appears as a crazing of the emulsion layer as it dries on smooth plastic, glass or ceramics. Cause: emulsion-base bond was good, but temperature change during processing or drying led to these rivulets of loss adhesion appearing. Cures: avoid rapid changes or extremes in temperature. Other treatments: as in 3.

5. Grey Highlights.
Are the image rebates clear?

If yes, the negative used was too flat. Reshoot, or make a duplicate negative to higher contrast. Kodak direct duplicating SO366 film can do this in a single step but can be tricky to use.

If no, then **light fog** may be present. The safelight could be unsafe or too close to the work, or maximum safelight duration has been exceeded. Work should only be exposed to safelight during coating and processing. Blackout during drying must be total.

Alternatively, there may be **chemical fog** due to:
(i) emulsion aging (a problem slowed by cold storage), which can be offset by adding anti-foggant to the developer or emulsion;
(ii) emulsion-developer mismatch. The developer may be too concentrated, or of unsuitable rapid RC type.
(iii) the emulsion is contaminated. Has it touched metal? Are implements scrupulously clean? Has base material contaminated emulsion, a situation calling for varnish/artist's primer as a barrier layer?
(iv) overlong development time with developer temperature too high. If long development time is desired, reduce temperature accordingly. Add anti-foggant.

Note: **stress marks** can be mistaken for fogging. High-speed emulsions are especially vulnerable.

6. No image, cause could be...

(i) insufficient exposure (possible if using the slower SE3 emulsion)

(ii) contaminants in the base layer have desensitised the emulsion; correct by adding or improving barrier layer.

(iii) processing chemicals are exhausted, or contaminated, or have been used in the wrong order.

7. Thin image, coating marks such as brush strokes, are possibly due to insufficiently thick coating. If using dilute emulsion, increase strength and apply two coats, drying in between. If using full strength, increase amount applied, work it more to give greater evenness. Other treatments: add wetting or bulking agents.

8. Blueish patches produced some time after processing occur when un-fixed emulsion (perhaps a locally extra-thick patch deposited by a coating tool) prints-out to strong light. If you are aware of such areas, try brushing double-strength rapid fixer onto them during the fixing stage.

9. Image streaks

Occurring during drying: too much heat is being used with too much moisture present. Emulsion is redissolving in the excess of water. Treatment: Air dry under gentle heat.

Occurring during processing: emulsion has not been allowed to dry properly, or the processing solutions / wash water is too warm.

10. Prints/areas that lighten after processing & drying indicate a high level of retained fixer, which is bleaching the image. Non-absorbent bases like perspex will reveal this problem soonest, e.g. the day after processing. Absorbent bases may accept excess thiosulphate and stabilise the material to some extent but fading may appear in the medium/long term. Other possible cause: excessively thick emulsion layer. You can check for retained thiosulphate, but the image can never be reclaimed. The first step is to reprint:
(i) aiming to control emulsion coating thickness, and
(ii) extending washing time by 100%.

11. Small white spots as with bubbles indicate small non-coated areas. Often found with rough surfaces in recesses missed by the coating tool.

12. Small black spots: these probably indicate local contamination from an impure base material, e.g. low quality wood or paper. Treatments: if working with paper, use a sizing agent; otherwise, barrier layers are required.

13. Fingerprints and handling marks

Black fingerprints are due to touching the print material with developer-contaminated fingers. White fingerprints are usually due to touching with fingers contaminated with fixer or stopbath. Prints may also develop grey or black stains from rough handling, or from an excessive developer temperature. Using exhausted developer aggravates this effect. Answer: avoid touching emulsion surface, arrange wide border around image.

14. Crystallisation effect. This tends to be seen when using SE type emulsions undiluted on a smooth, non-absorbent surface. Possible cause: a crystallising out of residual sodium sulphate, the manufacturer's precipitating agent. A small degree of dilution usually prevents its formation.

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