

CASTING IN SNOW

Because of the weight of Dental Stone and the heat given off during the curing of the cast we cannot use this material directly for capturing impressions in snow. The snow simply melts and the weight of the stone then destroys the impression.

Snow impressions can, however, be cast using one of two methods, poured sulphur or spray wax. These are discussed below.

CASTING WITH SULPHUR

Sulphur is used in molten form and therefore any form of sulphur is suitable for the purpose, including, sublimated, flowers, prills or block. Since any form is satisfactory, the cheapest possible source is the best.

Sublimated sulphur is available from laboratory chemical supply companies, but is very expensive since it is highly refined for pharmaceutical use. It is unnecessary to purchase this type.

Because sulphur is a by-product of certain industrial operations, it is often available from those sources in lump or block form at very low prices. Check the industries in your area.

It is also available in powdered form from agricultural or horticultural suppliers. If purchasing from those sources, make sure it is pure sulphur, containing no additives.

Method

While it may seem contradictory to use hot, molten sulphur to cast a snow impression, the process works very well in practice. The secret lies in the ability of sulphur to revert to a solid from a liquid as a result of only a very slight drop in temperature.

When brought to the correct temperature, and poured into the cold impression, the sulphur instantly solidifies, capturing the fine detail before the snow has time to melt.

Preparation

Since snow impressions are cast only in cold weather it is advisable to minimise the time spent at the actual site by making preparations well in advance.

Melting the sulphur from a stock supply takes time and can be messy when done outside in the wind. It is suggested that you do the initial preparation in the laboratory and then set the sulphur aside until it is needed.

First, obtain two or three saucepans of about three to four litre capacity (visit the local rummage or garage sales). The best ones for the purpose are thick-walled cast aluminum or iron.

Fill a saucepan with sulphur, in whatever form you have available. Then heat it slowly at a moderate temperature (approx. 200°C or 400°F) until it has the appearance and consistency of corn syrup. Keep adding sulphur until the pan is full. Do not try to speed up the process by increasing the heat. The sulphur will simply thicken to a toffee-like consistency and prevent you from easily adding more powder or stirring the mixture.

Once the pan is full remove it from the heat and allow it to cool. It will form a solid block in the pan which is more convenient to carry to the crime scene.

In the field

For field use, a propane or naphtha camping stove will provide adequate heat and will be easy to control. Situate the stove in a sheltered area, out of the wind. Since there is little smell it may be heated indoors on a kitchen stove if that is more convenient.

Melting sulphur produces fumes which have a mild smell and are non-toxic. It is unlikely, when melting the sulphur as described above, that the sulphur will catch fire.

You should be aware, however, that burning sulphur produces sulphur dioxide which has a characteristic bad smell and is toxic. Avoid breathing these fumes.

If it catches fire when you are working outside in sunlight, the pale blue flames will be difficult to see but you will immediately recognise the odour. Move to the upwind side of the pan and then throw snow onto the surface of the sulphur to extinguish the flames. Simply putting a lid on the pan will not extinguish the flame.

If it ignites when you are using a stove indoors, immediately carry the pan outside so that the fumes will be quickly dispersed and where you can then deal with it as above.

The melt will take about thirty minutes, since low heat must be used. Resist the temptation to use a higher heat to melt it more quickly. If it becomes overheated and thickens, do not pour, the thickened sulphur will retain the heat and will melt the impression before forming a hard cast. Allow it to cool and then bring it back to the correct consistency before pouring the cast.

Preparation of the Impression

As with any impression you will need to remove any debris which has fallen or been blown into the impression. You will also need to take photographs before you pour the cast.

The next step is to construct a pouring trough. Pouring the sulphur directly into the impression may cause damage at the point first struck by the relatively large volume of hot sulphur. Form the trough next to the highest edge of the portion of the impression that you wish to cast. You may first have to make a small pile of snow to place the trough slightly higher than the impression.

The trough allows you to pour the sulphur so that it initially flows over the impression in a thin layer, which immediately sets. The remainder then builds up the necessary thickness. Even if the heat then melts the snow the fine detail has already been captured.

In order to prevent the sulphur from escaping from a shallow impression, or to restrict the cast to just that part of the impression you wish to record, build a low containment wall of snow. Because snow impressions are often fairly deep this step will not always be necessary.

Pouring the sulphur

When the sulphur is completely melted, take the pan to the impression and allow it to cool by setting it in the snow with the lid off. Keep stirring occasionally as it cools, until small crystals, having an appearance similar to that of ice forming on water, begin to appear on the surface of the molten sulphur.

Each time you stir, the crystals will melt again as you bring hot sulphur up from the bottom of the pan. When you stop stirring the crystals will take some time to reform. As the sulphur cools this time will be

reduced. When the crystals form again immediately after you stop stirring, the sulphur has cooled to the proper temperature of about 46 °C (115 °F).

In this state the sulphur will instantly solidify if the temperature is now dropped quickly.

Give the melt a final stir and pour with a steady, moderately fast speed, into the pouring trough, continuing until the impression is full. As the sulphur hits the snow you will see it solidify and the following material will flow over the solid part until it too hits cold snow and solidifies.

You should pour until the cast has a thickness of at least 10 mm. Sulphur has little tensile strength and therefore is very brittle when set, so do not skimp on the thickness.

This is where a heavy-walled pan is better than the cheap thin-walled aluminum pans. With the latter type the heat is transferred so quickly that the sulphur solidifies in a layer 1-2 cm thick on the bottom and sides of the pan while it is still too hot in the centre to pour. This results in you having very much less molten sulphur to pour to form the cast. A heavy-walled pan, on the other hand, retains the heat better, allowing the sulphur to cool more evenly so that there is less stuck to the pan when the melt reaches the proper pouring temperature

Allow the cast to cool and solidify, which may take 5 to 15 minutes depending on air temperature. If the snow is only a thin layer on the ground lift the cast before the melted snow underneath refreezes and traps it in place. At this stage it will have a dark yellow translucent appearance rather than the opaque pale yellow of the cold sulphur with which you started.

Be very careful to ensure that the sulphur has had time to set all the way through. It will first form a crust on the top and bottom because of the cold snow and air but will still be molten in the centre. The thicker you have made the cast, of course, the longer it will take to cool and set all the way through. Attempting to lift it before it is fully set will result in you breaking through the crust, destroying the cast and getting molten sulphur on your hands. Be patient!

Even when fully set the cast will be very brittle and easily broken although the surface is quite resistant to damage from rubbing. Ensure that it does not get dropped or bumped while you are transporting it back to your office.

Once back at the office you can strengthen the cast by embedding it in a support pad of dental stone. Tack a few small lumps of sulphur to the back of the cast to provide a gripping area by heating one surface of the lump until it softens and placing it in contact with the cast. Then place the cast face down in a bed of sand, ensuring that it remains tightly embedded with no space around the edges where the dental stone can get under the sulphur cast. Build a cardboard retaining wall and pour the dental stone over the cast to a thickness of about 15-20 mm.

Alternatively set the cast the right way up, again preferably with lumps attached to the back, on the bed of sand so that the cast is raised above the surface about 15-20 mm. Place a retaining strip around it and mix and pour the dental stone so that it flows under the sulphur. Mixing the stone a little thinner than normal will ensure that it will flow under the sulphur satisfactorily.

Vandiver recommends adding fibreglass to the molten sulphur and claims that it will increase the strength by about fifty percent. He recommends adding about five percent by weight of 1/8" to 1/4" pieces of milled fibreglass.¹⁴ The very small size of the milled fibres should not interfere with the ability of the sulphur to record the fine detail of the impression. This method should be considered as an alternative to the bed of stone. It will not be necessary to do both.

Health and Safety Considerations

Sulphur is not toxic in the powdered or lump form but if you are handling it in powder form you should wear a non-toxic particle mask as you should when using fingerprint powder.

Like many otherwise harmless powders, it can be explosive if the dust is dispersed finely in the air in the presence of flame. When using an open flame burner to melt the sulphur take care not to allow clouds of sulphur powder to be formed in the vicinity.

If the sulphur catches fire and burns while melting, it gives off sulphur dioxide gas which, in sufficient concentration, is toxic. These fumes, if inhaled, will combine with the moisture in the respiratory system to form a weak sulphurous acid, which will be irritating to the mucous membranes. Stay upwind and, as noted earlier, put out the flames by covering with snow or, if indoors, carry the pan outside.

If stored in a damp area, sulphur will combine with the moisture to form weak sulphurous acid. Store it in plastic and keep it dry.

Keeping in mind the above comments, sulphur, used properly, does not present any significant hazards.

SPRAY WAX METHOD

An alternative way of recording impressions in snow is the spray wax method.

The spray wax used for this purpose is a commercial product supplied in aerosol cans. The idea originated in Sweden from experiments using spray-on imitation snow for Christmas decorating. Although the spray-on wax available in Sweden apparently worked well, a suitable brand was not found in Canada. Snow-Print Wax has solved that dilemma.

Snow-Print Wax is coloured red or orange for easier visibility on the snow surface.

The method requires you to spray the snow impression with the wax material, to a thickness of two to three millimeters. This records the detail of the impression and acts as an insulator. Then dental stone can be poured inside the wax layer without the exothermic reaction melting the snow before the stone has an opportunity to set.

Procedure

First spray a light coating onto the impression from about 10 - 12 inches away on the upwind side. Do not get too close otherwise the force of the spray may damage the impression. Allow it to drift across the impression and watch as the detail in the impression stands out more clearly because of the contrasting colour of the wax. At that point photograph the impression again.

Continue to build up the wax by applying two or three light, even layers at two or three minute intervals. The aim is to ensure that the entire impression, including the sides, is covered with a layer of wax. Any gaps or thin areas will permit the stone to pass through and damage the impression as it heats up.

When the spray is not actually being used to coat the impression keep it warm in a coat pocket or a heated area to prevent the cold from decreasing the pressure. If this happens it will tend to come out of the container in "spits" which will cause uneven spraying. Clean off any build-up of material around the spray nozzle. Occasionally the orifice will plug up. The suppliers anticipate this problem and supply several spray nozzles with each can of wax.

After the layer of wax has set for five minutes or so, mix up and pour a thick, warm mixture of dental stone on top of the wax. This can be mixed a little thicker than a normal stone cast since you are not recording fine detail on the stone, but simply supporting the wax. Take care to ensure that the stone does not overflow the wax coating and get between the wax and the impression.

Cover the impression with cardboard or a newspaper to retain the heat as the stone cures. Remove the cast as soon as the stone has hardened or it may freeze into the surrounding ice and snow. Trying to pry the cast loose will destroy the wax impression.

The wax surface is extremely fragile and you must take great care when handling and transporting the cast. Keep it in a shady area if you are continuing to work at the scene. Transport it in the trunk of the vehicle where there will be the least amount of heat. (Check for warm areas caused by exhaust pipes under the trunk) Do not allow other items to touch the wax surface, including any protective wrapping. It is best transported in an open box.

What some users have failed to realise is that the impression is reproduced on the wax, not on the stone. Cleaning off the wax removes the evidence.

Whenever possible photograph with electronic flash since it will quickly melt if you place it close to studio lights.

The wax never hardens and we are not aware of any method to strengthen this surface.

Cost

The wax is rather expensive and you will need a minimum of two cans so that one can be kept warm while you are using the first. A full footwear impression will require almost a full can of wax, tire impressions may require several cans.

EVALUATION OF THE TWO METHODS

During classes at the College, casts have been made on numerous occasions utilizing both Snow-Print Wax and sulphur methods, side-by-side in the same snow.

Most of these casts were made in January or February, in temperatures ranging from just above freezing to about minus twenty degrees Celcius. Snow conditions varied from ice with a thin covering of powder snow, to good packing snow, to spring-like "corn snow".

In virtually every case the sulphur method produced finer detail. Note, however, that these results are diametrically opposed to those reported by William J. Bodziak in his book "Footwear Impression Evidence"¹⁵. It must also be pointed out that on many occasions neither method produced the fine individual detail necessary for individualising the footwear.

Both methods have advantages and disadvantages. Because of the wide range of temperatures in Ontario, and the consequent varied snow consistencies, you would be best advised to try both methods in your own area. Then make your own comparisons and select the method which best suits your conditions.

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14. James V. Vandiver, SNOW CASTING WITH SULPHUR, Law and Order, June 1978, p. 80. (This is a good article on the use of sulphur.)