DATASHEET:

Stone-in-Place Casting: Has this casting technique revolutionized coloured stone pavé setting? By Suzanne Wade

The amount of colored stone pavé-set Jewellery available to the consumer has grown steadily in recent years, thanks largely to the widespread adoption of stone-in-place lost wax casting techniques. Stone-in-place casting dramatically reduces labor costs associated with manually setting the dozens of tiny gems used in pavé, permitting cost-effective, large-scale production of pavé pieces.

18K gold and colored stone pavé earrings from Piero Milano; photo courtesy Goldstein Communications.

In stone-in-place casting, a wax model of the Jewellery piece is created, and the stones are set into the wax prior to casting. In mass-produced pieces, a rubber mold of the finished piece is used to make multiple wax models. The waxes may be set individually with the stones, or in some cases, the stones may be placed into the rubber mold and the wax injected around them, to produce a wax model in which the stones are already set.

The wax model is placed into a flask and a fine-grained, heat-resistant plaster called "investment" is poured around it. Once the plaster has set, the flask is placed into an oven and heated until the wax burns off, leaving behind an empty cavity and the stones, which are held in place in the cavity by the investment.

In stone-in-place casting, gems are first set in a wax model of the piece to be cast. Photo by Dr. Hubert Schuster, courtesy Neutec.

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The Jewellery metal — normally gold or silver, since platinum's melting temperature is higher than most stones can tolerate — is melted and poured into the cavity, filling the space left by the wax. After the flask cools, a finished, stone-set Jewellery piece is removed from the investment.

The idea of setting gems in wax in order to save time and labor is nothing new, says Eddie Bell, president of Neutec in Albuquerque, New Mexico. "My first experience casting in place probably dates back to the mid-‘60s, and I find little pieces of information here and there that indicate there were other people doing that back then," says Bell. "It seems to me it's a fairly obvious kind of thing: If you are casting and you want stones to be there, you would try to cast around the stones. It wouldn't surprise me if somewhere along the line some ancient [caster] did that."

The same emerald and diamond ring after being set in white gold. Photo by Dr. Hubert Schuster, courtesy Neutec.

While many casters may have experimented with stone-in-place casting through the years, it took several technological advances to make the technique commercially viable. "Probably the most important thing that happened was the invention of magnetic finishing equipment," says Bell. "Magnetic pin finishers allow [the manufacturer] to do some finishing in back of the setting. Previously, we could cast with stones, but we couldn't finish the product as economically as we could set the stones."

Other technological advances, including the introduction of reduced-oxidation alloys that require less finishing and computer-controlled casting machines that permit precise temperature control, also helped make stone-in-place casting feasible on a large scale.

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But even with these technological advancements, there are still limitations to what can be done with stone-in-place casting. For example, only certain stones can be used in this technique. Since the melting temperature of gold is 1,700°F to 1,800°F (927°C to 982°C), stones must be able to tolerate fairly high temperatures. Stones that change color when exposed to high temperatures, such as amethyst or blue topaz, or which will burn at these temperatures, such as pearl and turquoise, are not suitable for stone-in-place casting. The most popular choices, unsurprisingly, are ruby and sapphire, which are durable stones with a high tolerance for heat.

Bell notes, however, that conventional wisdom regarding what stones can handle heat doesn't always apply. In experiments, he has successfully cast both synthetic emerald and opal, gems whose intolerance for heating is almost legendary. According to Bell's research, the determining factor is not just tolerance for high heat, but how well the gem tolerates uneven heating and cooling.

Successful stone-in-place casting also requires careful design of the settings, so that the investment will hold the stone securely during the casting process. And even with good design and execution, a certain number of stones will loosen or crack during casting. As a result, stone-in-place casting is almost never used for setting large, fine quality gems, which are expensive to replace if damaged.

While stone-in-place casting has been hailed as a breakthrough technology by volume Jewellery manufacturers, not everyone is as enthusiastic about the technique. Some bench jewelers complain that the quality of stone-in-place cast pieces does not equal that of traditionally-set Jewellery. "The problem is that in order for the stones to both be properly held by the investment, and not damaged by the molten metal, the cast metal can only barely touch the stone," says Peter Rowe, a jeweler for B. Sholdt Jewelers in Seattle. "Seats [to hold stones in place] are minimal, the metal under the stones is also minimal, and has to be for the technique to work. . . . [So] generally, the settings aren't as secure. Many times, even trying to size one of these rings causes stones to loosen or fall out." Certain design modifications made to help keep stones in place during the stone-in-place casting process can negatively affect the setting's structural security.

Others say pieces made using the technique can be quality pieces, if care is taken in design and manufacturing. "Well-made cast pieces are like well-made handmade pieces — they're well made," says Bob Lynn of Lynn's Jewellery in Ventura, California. "Badly made are badly made, and it doesn't matter [what method is used]. The biggest thing is the stone sizes have to be correct, the beads have to be correct, etc. God, the devil, and quality are all in the details."