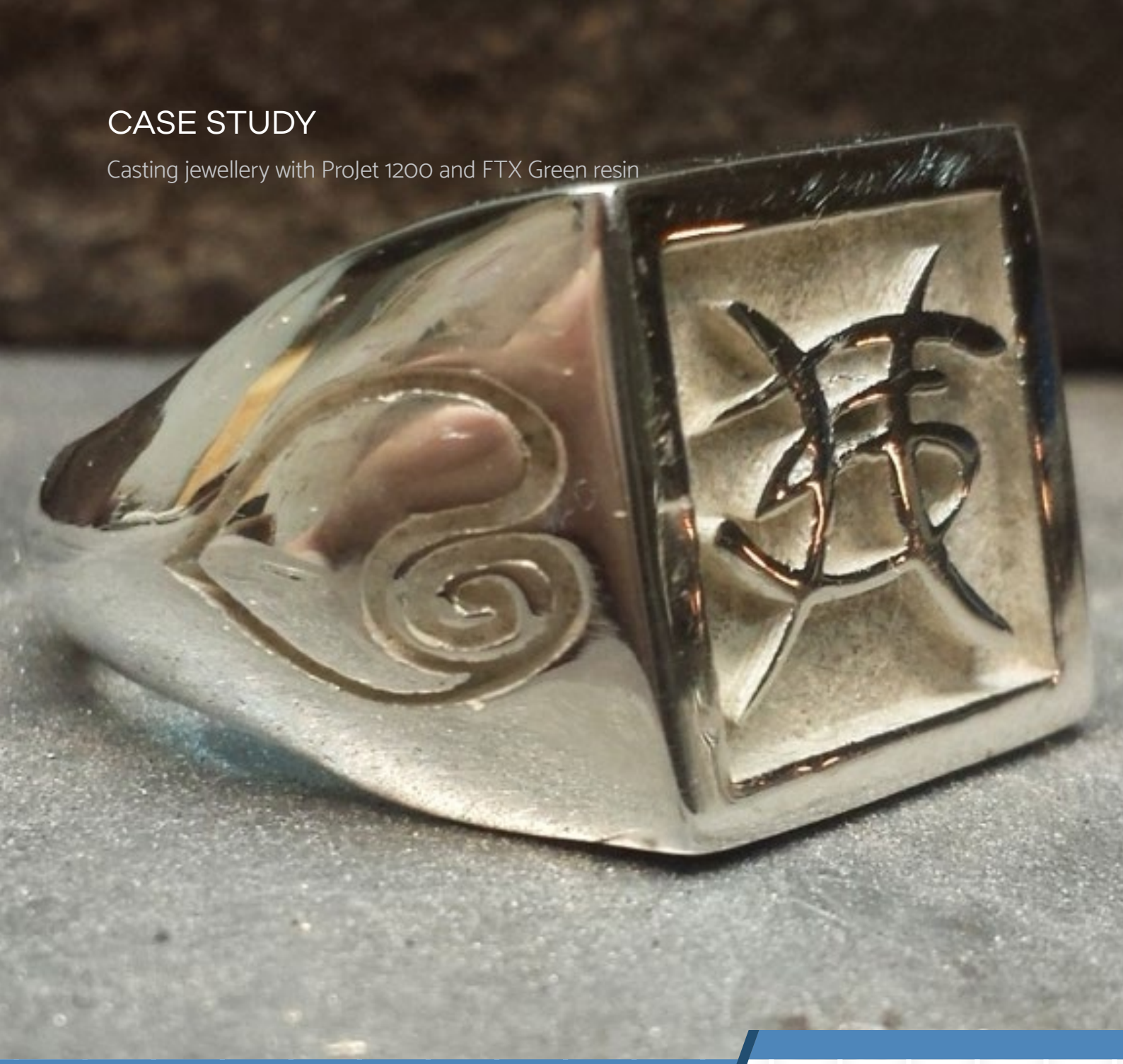
CASE STUDY

Casting jewellery with ProJet 1200 and FTX Green resin



SICNOVA 3D

PLATAFORMA INTEGRAL TECNOLOGÍA 3D

Jewellery Casting with ProJet 1200 and FTX Green resin

EXPERIENCE IN THE FIELD

Manuel Ángel García Quijada is an expert jeweller from Cieza (Murcia, Spain), where he is currently based in his privately owned workshop. Manuel is a master craftsman in gold and silver work, he also specialises in prototyping, design, engraving and microfusion. He began work in this area of expertise in 1987, having been drawn to the profession by its creative aspect. Since then, Manuel has gained extensive experience which has made him the expert jeweller he is today.

CHANGES OVERTIME

Since the beginning of Manuel's career, some things in the jewellery field have experienced change. While the creativity of the craftsman has remained unchanged, the irruption of new technologies, like **3D printing, has helped to improve and facilitate certain production processes**. However, there are times when one must take recourse to more experimentation and undergo a first phase of trial and error before reaching results that are 100% effective each time applied, which is determined by the hardware and the specific materials being used. And in some cases, we have received complaints from professionals in the jewellery sector who have been unhappy with the results they have seen when they have casted manufactured pieces **Systems' MicroSLA ProJet 1200** printer.

PROFESSIONAL WORKSHOP

For this reason, the workshop **Taller García & Quijada (misjoyas.es)** has joined forces with **Sicnova 3D** in the aim of achieving satisfactory results in their jewellery casting, which is carried out with the 3D **ProJet 1200** printer, and along with the **FTX-Green** resin.

FTX GREEN VERSUS FTX CAST

The FTX Green resin, in comparison with FTX Cast, has the advantage of having thinner fulcra that are more easily removed. This avoids the risk of accidently breaking pieces off the piece itself that is being worked on. In addition, the resin in question is a harder one and is therefore more easily worked.

Designing a piece in 3D

MACHINERY AND MATERIALS USED

Machinery used in this process is not so different from that usually employed when designing jewellery. To be specific, the following are used:

- PIREX test tube of millimetric precision (N.B. important).
- Stopwatch.
- Destilled water.
- Phosphate-based plaster and mixing liquid. (Whip Mix Formula 1).
- Plastic container and a fork (a fork will give better results than a whisk, which gives rise to air bubbles in the mixture).
- Metal cylinders with lids.
- Protective mask.
- Vacuum pump.
- Single oven that has a resistance of just two ohms, an air outlet in the upper central part of the apparatus (in the roof) and an outlet for wax residue that can only be programmed for use when the oven is at maximum temperature or during the transitionary period from when resistancy is switched on and off.
- Centrifuge with springs for automatic spinning.

THE WORK PROCEDURE

Work is carried out as customary in the field of jewellery casting, placing the resin models in the printer shaft as though they were any sort of ordinary wax. In terms of temperature adjusting and the details of the procedure to follow, here is a step-by-step illustration of a real procedure:

- First, the cylinders were prepared (three in total), at 6pm on the 3rd of March 2016. Plasti-Cast was used for two of these and Whip Mix Formula 1 for that remaining. The process was completed at 7pm.
- The cylinder in which the Whip Mix Formula 1 was placed was ready for use half an hour later.
- In principle, cylinders made from Plasti-Cast should be left to set over a period of two hours, however, an hour and a half proved to be a sufficient length of time.

Resin model

INVESTMENT IN THE CYLINDER

- At 9pm the pieces were put into the kiln, which was programmed to start off at room temperature at 5am on the 4th of March 2016, rising steadily by 3 °C per minute until reaching 500 °C. From that moment, oven power was increased in order to reach a relatively constant increase in temperature.
- At 10:10am the oven reached 732°C and remained at that temperature for two hours.
- Once two hours had gone by, the oven temperature was reduced to casting temperature. The first cylinder was gold and was put in at 610 °C as it had very thin pieces. The decline took 25 minutes and there was no time allocated to a period of temperature stabilisation, rather, casting ocurred instantaneously and the cylinder had its mould ready.
- Having put the melting pot for silver in and reduced oven heat to 590 °C, the Whip Mix Formula 1 cylinder was then smelted and poured. The result was almost optimum.

Investment in the cylinder

Breaking the plaster casting

CLEANING

Once having removed all plaster possible, the piece was left overnight in acid (in this particular case, in TecnoFlux paint stripper powder) and any final cleaning was carried out with an ultrasound device.

The marks of the construction supports are circled in red, and the burr marks in yellow. Although it may not appear so, the porous surface can be evened out easily with a file and sandpaper

A filed piece

A buffed surface. The blade from a hacksaw is held up so that the level of detail can be appreciated

Destroying the undercut details, either partially or totally, is one of the most common errors made, as well as making holes in larger, chunkier solid pieces

CASTING

Lastly, the third cylinder was cast, and with optimum results. The resin began to lose its form at approx. 300 °C and by 600 °C (or possibly slightly before hitting the 600 mark), nothing was left of it. What was fundamental at this point was that the plaster remained intact as the resin burnt, and this was a successful case. The cooking temperature was between 650 and 900 °C, this being the conventional range the jeweller uses, although he does recommend you test the powder/liquid relation as you go and judge from there.

ADVICE FOR OPTIMUM RESULTS USING FTX GREEN

According to this jeweller's experience, castings such as Kerr Satin Cast 20, as well as Plasticast, Ultravest and R&R's Argentum do not perform well with resins FTX Green nor FTX Cast. Nonetheless, desireable outcomes can indeed be achieved using other castings, such as **Whip Mix Formula 1** which obtains optimum results. This is a phosphate-based casting that needs to be mixed with a specific liquid and, depending on the mixture, with destilled water as well. It is extremely hard, which makes extraction of the pieces difficult. This casting is also quite a deal more expensive than ones jewellers typically opt for, but if the space within the cylinder is strategically managed a high yield can be obtained and you can reap the benefits of the optimal outcome this product delivers. García Quijada warns that the thickness of Whip Mix Formula 1 is greater than the norm that jewellers are accustomed to working with, and this means that a larger quantity of plaster is required to reach the same number of cubic centimetres. For instance, a sachet containing 150 grams can fill **up to 44.08 cc**. Likewise, Plasti-Cast tends to expand a lot during the casting process, for which reason you must be careful not to let the container overflow lest mixture be lost. With regard to deflasking, as jewellers are aware, if a cylinder is put in water that is too hot, the plaster decomposes and pieces break off. However, this is not the case with this product, which remains unaffected and consequently has to be broken with a hammer and chisel. The best option is **not to use a metal cylinder at all, but a plastic one**. This way, after casting has occurred, the pieces can be released much more efficiently with just a few knocks to the side of the cylinder.

MIXING SOLUTIONS WITH WHIP FORMULA 1

There are various possible mixing solutions that can be made with this product, as outlined in the table below:

Expansion Ratio Chart								
Two minute mix time					**60 gram**		**100 gram**	
					13 mil/60 gram		22 mil/100 gram	
				Liquid concentration	Liquid (ml)	Water (ml)	Liquid (ml)	Water (ml)
Expansion	Alloy	More		100 %	13,0	0,0	22,0	0,0
				90 %	12,0	1,0	20,0	2,0
		Optimum	Base	80 %	11,0	2,0	18,0	4,0
			Noble	75 %	10,0	3,0	16,5	5,5
			Hight noble	70 %	9,0	4,0	15,0	7,0
		Less		60 %	8,0	5,0	13,0	9,0
				50 %	6,5	6,5	11,0	11,0
	Ceramic	More		90 %	12,0	1,0	20,0	2,0
				80 %	11,0	2,0	18,0	4,0
		Optimum	Crowns, veneers	70 %	9,0	4,0	15,0	7,0
			Inlays, MODs	60 %	8,0	5,0	13,0	9,0
		Less		50 %	6,5	6,5	11,0	11,0
				40 %	5,0	8,0	9,0	13,0

Source: Whip Mix Formula 1

Cleaning the printer

Furthermore, García Quijada recommends cleaning out the inside of the printer to guarantee that the best possible results are achieved.

He explained that when one of the cartridges broke, he took out the glass that was beneath the cartridge and saw there was a clear mark on it from the support structure upon which the piece was constructed. He cleaned the glass, which he says was no easy job, and claimed that the printer subsequently printed better than when he had bought it brand new. This improvement can be seen with, for instance, smoother or flat pieces, as well as with higher quality support structures.

ACKNOWLEDGEMENTS

Sicnova 3D would like to thank the workshop "Taller **García & Quijada**" for their time and effort cooperating with us to obtain optimum operational results, and for their willingness to share publically their experience working with our 3D printer, which has been recounted in this case study. Manuel Ángel García Quijada would like to thank **Sicnova 3D** on his behalf for reaching out to him to find a solution to the casting problems which the machine in question had been causing professionals in the jewellery business. In his own words, Manuel expressed his appreciation to us for being the only company to have taken the time to apologise for not having been able to give him a solution to these casting problems, and for having funded his investigation (which he pointed out was a non-profitable contribution), which will benefit everyone, and in particular jewellers and professionals in other similar fields of work.

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