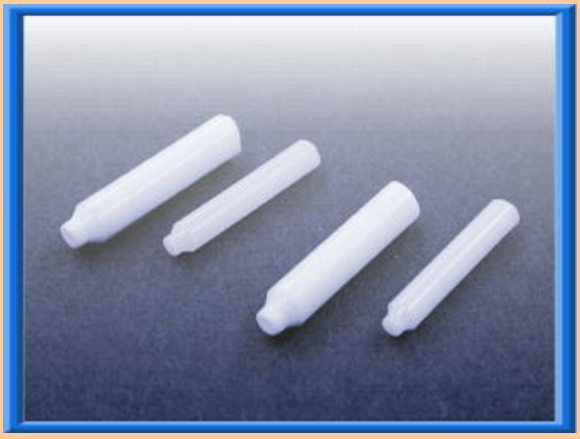
Explanation of Zirconia Ferrule Blank's Production System



TAMMY MACHINERY CO, . LTD.

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Ⅰ Introduction

1.What's "ferrule"

Any more, the communication means which optical fiber was used for is not only for the long-distance communication such as some of the telephone companies.
For example, it develops in the building for making better use of LAN and the Internet.
In addition, it develops in the short distance in the family use, too.
It is expected to increase the demand for the "patch code", due to increasing the communication in the short distance and the number of circuits.
("Patch code" is fixed a connector on both ends of the optical fiber) .
The main part of the optical fiber connector is "ferrule".
The connector of the optical fiber is required the precision of the μm unit ,to restrain the loss of the light to a minimum.
It is different from connector of electric wiring.
The material of ferrule is used zirconia ceramic for the keeping of the precision quality.

2. Importance of Blanks.

Of course, a progress in precision machine processing is important to make the high precision ferrule.
But, the precision of the blank before machine processing, gives a big influence of yield at final step, too.
As before, the blank was made by extrusion moulding.
In the present, injection moulding which PIM (powder injection moulding) was used for is the main stream.

3. Problem until now .

Recently, PIM technology is useful technology, for example it is the production of the watch parts by MIM.
But, it is difficult to make the mould that when the a high precision parts like a ferrule blanks made.
The problem was how to make a thin pin (about φ0.150) and a thin hole.
But now, many manufacturers can already make a thin pin.

The problem in production of mould is the following point.
①The production of high precision mould parts.
②Keeping of the mould's precision during injection moulding
③The design affected by the characteristic of special compounds, used PIM

Without understanding the above ,only a pipe with thin hole is made, a good ferrule blank can't make it.

4. TAMMY's moulds and systems.

TAMMY's moulds are supplied to the leading plastic makers which products ferrule blanks.
Because of that, TAMMY's moulds is good for the high precision mould, which is maked by the original way, and is affected by the characteristic of PIM.
This mould is accepted even if a plastic ferrule mould is taken.

The system base is mould, which is the biggest factor (structure, production and blank design) of the ferrule blank's production.

Because of that,
①High precision = a few loss in the later process
②The system adapt PIM = man-hour reduction, high yield

Thus, it is possible high quality and the low cost on this syste

Refer to following page for the details of the system.

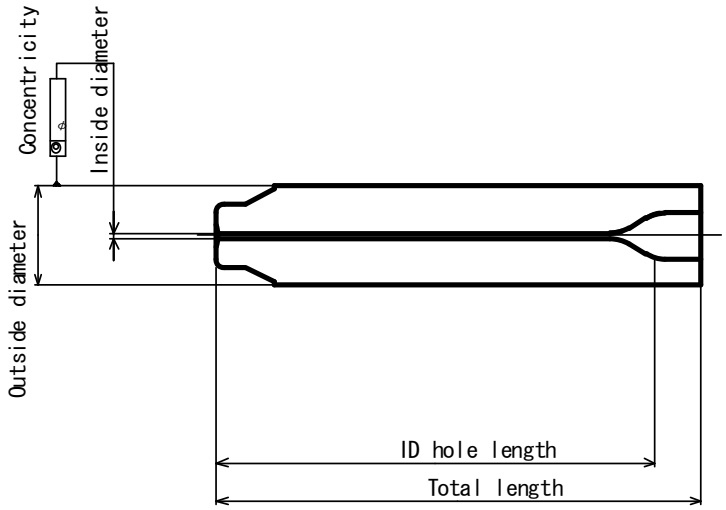
Ⅱ Quality Guarantee

Promising dimension

Item	Allowance	Measurement instrument
Outside diameter	(φ2. 6＊)±0. 03	Micro-meter
Inside diameter	(φ0. 11＊)±0. 003	Pin gauge
Concentricity	◎φ0. 03	ID center -OD meas.
ID hole length	(11. ＊＊)±0. 1	Updial gauge and jig
Total length	(12. ＊＊)±0. 5	Calliper

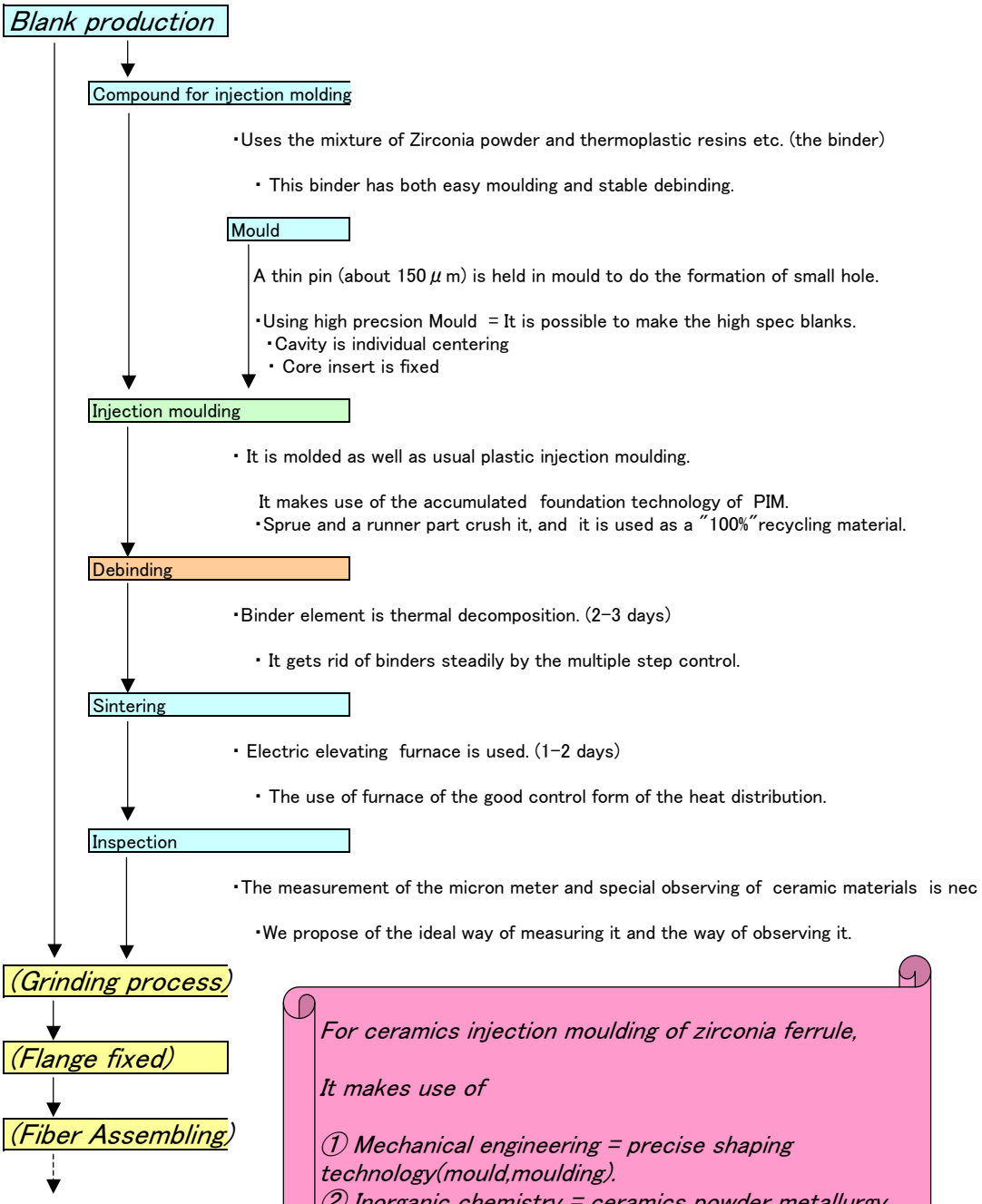
Note : The method of concentricity = our company designated machine is used and measuring point is specified by our company.

Note : Concentricity= essentially,ratio of less than 20 μm is more than 80% .



Ⅲ System

1. Abstracts (process flow)



:essary.

2. Material

1. The characteristics of compound

・This binder has both easy moulding and stable debinding.
・There are a few dimension changes in case of recycling material use.
・There are often a few occurrences of the bad smell in debinding ,that the binder is goot thermal degradation.
・The occurrence of contamination and void is restrained as much as possible.

2. Material list

No	Material name	Specifications
1110	Zirconia compound(O)	Use of OZC powder
1120	Zirconia compound(T)	Use of TZ powder

Powder : Y2O3=3mol % and Al2O3=0.25wt %
Binder = Butylmathacrylate, wax, and others

3. Technological information

①The choice of compound in consideration of moulding and debinding
②Preservation and handling method

4. Others

・We recommends Compound is the same grade to stabilize a process.
・When user's orizinal compound is used, it becomes a conference separately.
・As for compound technological transfer, it is being examined.

3 Mould

1. The characteristics of the Mould

・Individual centering structure is adopted. (The next page reference.)
・Precision emphasis structure is adopted.
(the moveable part which form small clearance is reduced) (The next page referen
・The time of Core pin is breaking is rather rare
・The producible precision of the key parts which decides concentricity is very hig
・It is special designed sprue and runner in accordance with ceramic compound.

2.Mould type list

NO.	Mould name	Outside size
2110	SC 4 cavity	210x200x200
2120	SC 6 cavity	210x200x200
2130	SC 8 cavity	280x230x220
2210	LC/MU 4 cavity	210x200x200
2220	LC/MU 6 cavity	210x200x200
2230	LC/MU 8 cavity	280x230x220

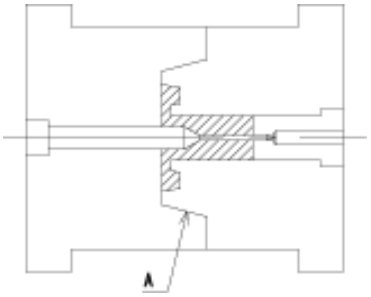
3. Technological information

①Mould structure
② maintenance (assembling ,adjustment)
③The proposal and design of blank shape

4. Others

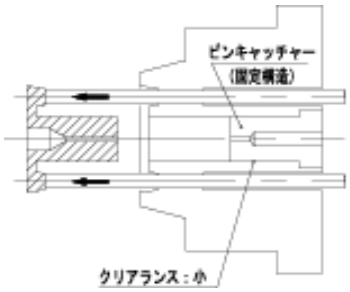
・The dimensional data of cavity part are attached.
・It meets hope, and trial data by sintering body and green body are attached.

centering of each cavity

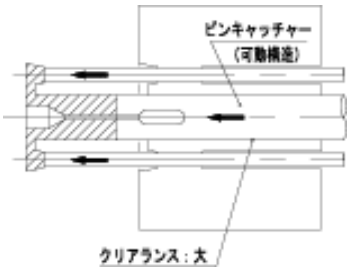


The structure of the precision emphasis

By TAMMY



By other companies



A mold manufactured by the Tammy is fixed structure to restrain play of the pin catcher. The concentricity of green body improves by making a clearance small. And, because it doesn't move, a life is long without abrasion.

4 Injection Moulding

1. The characteristics of the moulding process

・We proposed the stable moulding condition which is based on the compound and the mould
・ The electromotive injection moulding machine which is suitable for CIM is used , in consideration of the stability of molding.
・Sprue and a runner part crush it, and it is used as a ″100% recycling″ material.

2. Main equipment

NO.	Equipment name	Specifications	Outside size
3110	Injection moulding machine 20ton	Electromotive	2750x1650x910
3120	Injection moulding machine 40ton	Electromotive	3340x1715x1015
3510	Mould temperature controller	Water, max 95℃	250X600X600
3520	Runnner removing robot	Turn type	800X1200X450
3530	Conveyer	With the reversal mechanism	2000X1000X450
3540	Sensor	Check moulding material.	
3610	Compound dry & storage box	prevention of wet	88x90x38
3630	Crushing machine	Special specifications	350x650x200
3640	Finishing zigu	For the gate treatment	-

3. Technological information

① Injection moulding condition
②The method of runner recycling
③The method of gate finishing

4. Others

・ As for Injection moulding machine handling, attend the class of the Injection moulding machine manufacturer separately.

5 Debinding & sintering

1. The characteristics of debinding & sintering

・Concentricity is maintained when material without brim set lying during debinding & sintering, because the high precision mould used.
・The most suitable debinding condition is proposed in accordance with compound.
・Sintering condition which is suitable for the use Zirconia powder is provided.

2. Main equipment

NO.	Equipment name	Specifications	Outside size
4110	Debinding furnace(ex.)	Effective area 800x800x800 (max 600℃)	1900x2600x1380
4210	Sintering furnace(ex.)	Effective area 350x700x350 (max 1600℃)	1200x2390x1830
4510	Setting case	Porous AL203	120X120X23

3. Technological information

①Debinding condition (temperature raising pattern and others)
②A setup of device
③The choice of setting case

④Sintering condition (temperature raising pattern and others)

6 Measurement

1. The characteristics of the measurement einstruments

・We proposes measurement and observation method in the needs .
・ It is provided by the original specifications and so on with a moderate price.

2. Main instruments

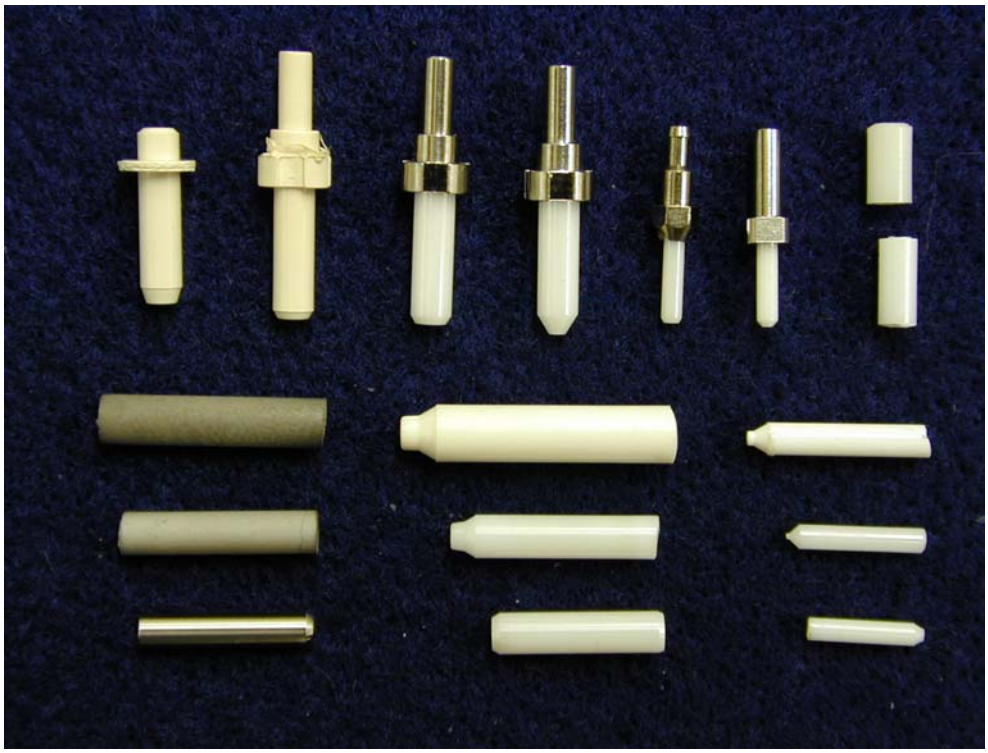
NO.	Instruments name	Use & specifications
5110	Concentricity measurement instrument	1μm indication and operation by hand/original made
5210	Pin gauge	Standard gauge, stops gauge/WC
5220	Wire	Usually check / W wire
5310	Micro-meter	Outside diameter /
5410	Magnifier (×10)	Appearance inspection/
5420	Microscope (×30)	Appearance inspection/
5430	Halogen light source	Crack inspection/
5510	Measurement microscope	Form measurement and others /
5910	An electronic balance (0.01g indication)	Counting number /

3. Technological information

①The requirement dimension of ferrule blank
②The appearance requirement of ferrule blank

4. Others

・ Decide an actual measurement item with the later processing makers or section.

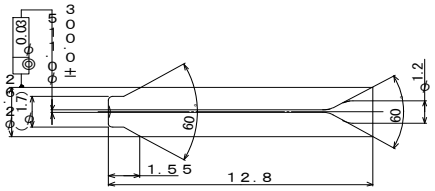


Ⅳ Grinding process

Processing chart of SC Ferrule(reference)

SC material drawing

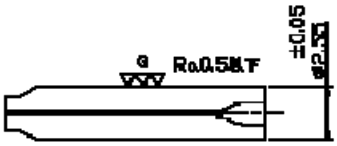
Material



Outside coasing

Coarse grinding of outside diameter

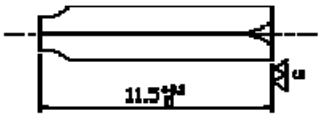
Coarse centerless grinder SKS-N250



V end coasing

Length process

Horizontal grinding machine SGM-6301



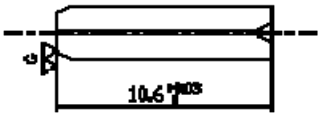
Pointed end coasing

Horizontal grinding machine SGM-6301

Air Press FCP

clean in water

clean in water ethanol by ultrasonic wave



Inside finishing

Metal fixing

Inside diameter process

Metal fixed machine S-4H

Wire winding machine TWM-1

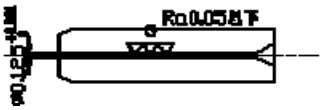
Wire etching machine TBW-1

Inside Rapping machine TL-3

Clean in hot water by ultrasonic wave

Clean in nitric acid by ultrasonic wave

Clean in water by ultrasonic wave

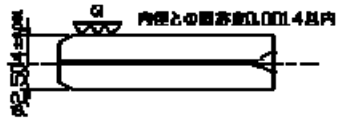


Outside finishing for concentration

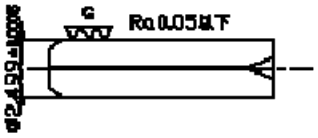
Outside diameter grinding process

Outside grinding machineTS-2A

clean in water

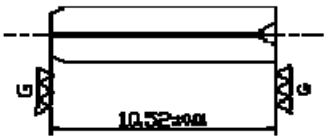


Outside finishing process
O/D finishing centerless grinder
MSA-250BN
Outside diameter finishing machine
SRL-150E

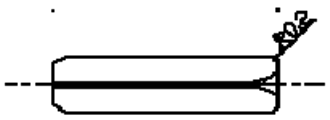


Coarse grinding of outside diameter
Coarse centerless grinder SKS-N250
Clean in water

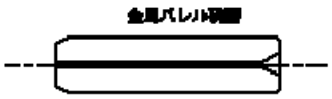
V end finishing
Horizontal grinding machine SGM-6301
Clean in water
Corner grinding of V end



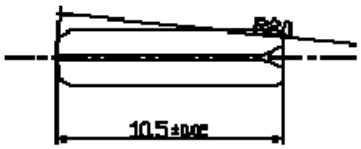
Brushing process
Outside chamfering machine(Brush type) PM-1
Clean in hot water by ultrasonic wave
"SAHFURON"ultrasonic wave
Clean in water



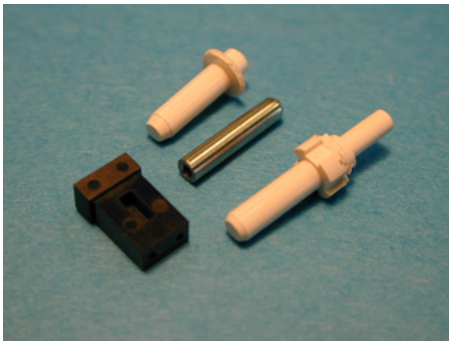
Polishing for all corner
Barrel process
Centrifugal barrel machine HS-4V
Clean in water



PC polishing process
Polishing machine GFP-240H
Clean in hot water by ultrasonic wave
"SAHFURON"ultrasonic wave
Clean in water



Final inspection
Auto inside diameter selection machine IM-500
Auto concentric level instrument CM
Auto outside diameter measuring instrument
PC measuring system OSR-21
Check aeviation
Check riughness of surface
Appearance inspection



Ⅴ Schedule & etc

Starting schedule

Preparation for equipment introduction	3～3．5 months
Machine setting	About 2 weeks
Technological guidance	About 2 weeks
Observation and advice	14～30 days

We desire customers to do next terms

①Give securing of technological staff.
- Mould : Staff can appreciated mould structure , and can take a part and cleane a mould.
- Injection Moulding : Staff can start machine and change a moulding condition.
- Equipment : Staff can operate and maintaine debindeing furnace and sintering furnace.
- Material : Staff have knowledge to understand the degradation of polymer and sintering .
- Measurement : Staff can measure minimum(one) micron meter.

②Give securing of mass production experience manager.
③Give securing of inspector (good eyesight) .
④Be separated from product according to type in each process
⑤The environment in process is clean and keep clean.
⑥Location should do in industry area.

Others.

Customer should make an arrangement of house and the following incidental facilities. .

- Power supply.
- Cooling water.
- Air conditioner.
- Compression air.

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