



## Syalon Ceramics for Aluminium Smelting

Aluminium smelting utilises the Hall-Héroult process of extracting aluminium metal from its oxide, alumina. In this process, alumina is dissolved in cryolite at about 1000°C in a large pot. This mixture is then electrolysed, causing the heavier liquid aluminium to be deposited at the cathode at the bottom of the pot. The aluminium can then be transferred to casting or extrusion facilities for final forming or cast into ingots for re-melting.

Downstream of the smelter, where the filter boxes and holding furnaces for the casting are located, a material with a proven history of success in temperature measurement and for heater tubes is **Syalon**, a silicon nitride based sialon ceramic from International Syalons Newcastle Ltd.

ISN were the first company in the world to patent and market advanced sialon ceramics and we are experts in this field. Amongst the companies who licensed our materials were Hitachi Metals, Kurosaki and Kennametal. Our latest Syalons have been developed to outperform other silicon nitride and sialon materials, as well as traditional materials such as cast iron and silicon carbide.

Syalon offers the following advantages over these alternative materials in aluminium smelting applications:

- **Non-wetting to aluminium and its alloys**
- **Very strong and durable**
- **Minimal build up of dross**
- **Extended service life**
- **Corrosion resistant**
- **Excellent thermal shock resistance**
- **Low maintenance**
- **Less downtime**



## Syalon Products

### Thermocouple Protection Sheaths (Thermowells)

**Syalon thermocouple protection sheaths** have excellent thermal shock resistance, are non-wetted by aluminium and are corrosion resistant. These features allow constant temperature monitoring thereby increasing the quality of the melt. They are available in a range of standard sizes as shown in the table below. These are usually available ex-stock. Tubes outside these standard sizes are also available but with a slightly longer lead-time.

OD/mm	ID/mm	Maximum Length/mm
28	16	2000
22	12	2000
16	9	2000
12.5	6.5	1150
9	4	600

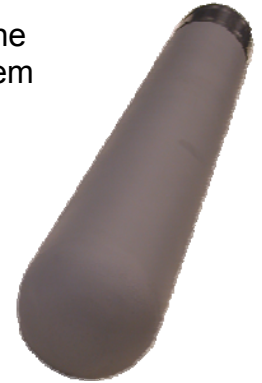




## Heater Tubes

**Syalon heater tubes** offer long life, improved process reliability and are cost effective. The range of heater and riser tubes available is diverse, including tubes with an integral flange, grooved tubes with a metal flange or plain end tubes. Syalon heater tubes can be made up to 1500mm in length with a maximum diameter of around 300mm. A selection of the tubes available is shown in the table below. The excellent thermal shock resistance and strength of Syalon heater tubes make them effective for both electric and gas fired heaters.

OD/mm	ID/mm	Max Length/mm
120	100	1500
140	120	1500
160	140	1500
170	150	1500
190	165	1350
200	180	1500



## Syalon Properties

Syalon components for aluminium molten metal handling are uniquely available in three grades offering a variety of outstanding properties, as shown in the table below.

Properties	Units	Syalon 101	Syalon 050	Syalon 110
3 point RT Modulus of Rupture	MPa	945	800	500
3 point MOR at 1400°C	MPa	-	450	150
RT Young's Modulus of Elasticity	GPa	288	306	139
RT Hardness (Vickers Hv <sub>0.3</sub> )	Kg/mm <sup>2</sup>	1350	2000	1200
Fracture Toughness K <sup>1</sup> C	MPam <sup>1/2</sup>	7.7	6.5	3.5
Density	g/cc	3.23	3.23	2.65
Porosity	%	0	0	<10
Thermal Expansion Coefficient (0-1200°C)	K <sup>-1</sup>	3.04x10 <sup>-6</sup>	3.2x10 <sup>-6</sup>	3x10 <sup>-6</sup>
RT Thermal Conductivity	W/(mK)	28	20	27
Thermal Shock Resistance	ΔT°C quenched in water	900	600	800
Maximum Use Temperature	°C	1200	1450	1500

**Syalon 101** offers the best mechanical strength and thermal shock resistance and is the most commonly used grade for molten metal handling applications. **Syalon 050** offers improved mechanical strength at high temperatures and improved corrosion resistance in extreme environments. **Syalon 110** offers the capability of operating at temperatures around 1500°C with improved non-wetting properties.

Please contact us to discuss your requirement for Syalon advanced ceramics in aluminium smelting applications.

