



INTERNATIONAL  
**Syalons**

**HIGH PERFORMANCE  
ADVANCED CERAMICS**

## Metal Forming Applications

International Syalons manufacture a range of components for **metal forming** applications, such as **welding**, **extrusion** and **cutting**. These applications can all benefit from the use of **Syalons**, the worlds first advanced ceramic alloys, and **Zircalon**, a super tough advanced ceramic.

### Syalon 101 / Syalon 050 / Zircalon

**Syalon 101** is a general purpose advanced ceramic whose unique combination of physical properties such as **high strength**, **toughness** and **hardness** impart **excellent wear resistant properties**. In addition **Syalon 101** has excellent **thermal shock resistance**, **corrosion resistance** and can be used at temperatures **up to 1000°C**.

**Syalon 050**, although not as strong and tough as Syalon 101 has significantly **greater hardness**, making it particularly suitable for arduous wear applications. In addition **Syalon 050** as well as possessing excellent **corrosion resistance** can be used in applications **up to 1400°C**.

**Zircalon**, possesses **high strength** and is extremely **tough**, is **electrically insulating** and excels where severe impact is expected. However, Zircalon is not recommended where thermal shock may occur.

These unique set of physical properties give **Syalon 101**, **Syalon 050** and **Zircalon** a distinct advantage in many metal forming applications over metals and other ceramics such as alumina and silicon carbide.



### Welding

**Syalon 101** and **Zircalon** are firmly established in the **resistance welding sector**, particularly as weld location pins for welding captive nuts to body panels in automotive and commercial vehicle assembly. Syalon 101 weld pins have a proven history of success of more than 15 years by several leading automotive manufacturers. Syalon 101 and Zircalon weld location and control pins are available, often ex-stock, in a comprehensive range of sizes.

International Syalons also manufacture a variety of welding **jigs**, **fixtures**, **shrouds** and **nozzles**, which for example may be used in **orbital welding**, **tungsten inert gas (TIG) welding**, **metal inert gas (MIG) welding**, **induction welding** and **plasma welding**. Syalon 101 gas shrouds have performed thousands of cycles giving hundred fold increases over conventional materials. In the TIG welding of steel tubes in heat exchanger cores, Syalon 101 nozzles have outlasted alumina nozzles by a factor of 10 to 1. In a plasma welding operation, Syalon 101 nozzles were found to be more durable than both alumina and silicon nitride.

Syalon 101 is particularly suitable to welding applications as it has excellent thermal shock resistance and is unaffected by thermal cycling stresses generated during welding operations. Its excellent physical properties make Syalon 101 less susceptible to mechanical damage. It is also resistant to weld spatter, which greatly reduces production down time for cleaning. Furthermore Syalon 101 is electrically insulating.



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## Metal Forming Applications continued...

### Extrusion Dies

The **extrusion and drawing of copper, brass and nimonic alloys** requires the use of a die, traditionally manufactured in steel. In recent times however, extrusion dies manufactured in **Syalon 101** have been successfully used to overcome many of the problems traditionally associated with metal dies, such as poor surface finish and short die life.

**Syalon 101** possesses a number of properties which make it an excellent candidate for extrusion dies. These include **high hot hardness, strength and toughness, excellent thermal properties particularly thermal shock resistance, chemical stability and good frictional properties.**

When extruding nimonic alloys, Syalon 101 dies last up to 120 times longer than steel dies. For extruding brass, Syalon 101 dies extruded 250 tons compared to 100 tons through conventional dies. For copper, Syalon extruded 75 tons compared to 40 tons for a conventional die.



### Cutting Tips

One of the earliest successful applications of **Syalon** was as a **cutting tip** or throw away insert for nickel based alloys and also as a tip for drilling in mining applications. Metal removal generates tremendous heat and even when a coolant is used, temperatures of 1000°C at the cutting edge are commonplace. If a cutting tip has poor thermal conductivity, then the heat cannot be dissipated. The thermal damage is exacerbated by high thermal expansion coefficient and crater wear develops, leading to the rapid destruction of the cutting edge.

Most turning operations involve 'interrupted' cutting, whether by accident or design. For example, in the turning of a roll of chill-cast iron the existence of pin holes and local asperities makes the cutting action intermittent. Thus as well as having suitable thermal properties, cutting tools must be tough.

In addition, work pieces are often hard and can be abrasive so the cutting tips should have a high hardness. Finally, the metallurgical properties of the work piece may be such that at the high temperatures generated a chemical reaction takes place between the tool and the work piece. So chemical stability is important.

These demanding requirements are met by **Syalon 050**. It is **thermally stable up to 1400°C, thermal shock resistant, hard, tough and strong and chemically resistant to corrosion.** In use, Syalon 050 cutting tips reduced by 75% the machining time for turbine discs for a Rolls Royce engine.

### Summary of Benefits

In metal forming applications Syalon and Zircalon offer the following benefits over metals and other ceramics:

- **High strength, toughness and hardness giving excellent wear resistance.**
- **Excellent chemical stability, particularly in contact with many metals.**
- **Excellent thermal properties in these often extreme applications.**
- **Improved component life and increased productivity.**

### Technical Support

The successful integration of ceramics into industrial and engineering systems requires close collaboration between you, the end-user, and us, the material suppliers. Our Technical Specialists are available to discuss your requirements in detail and assist in exploiting the significant advantages which **Syalon 101** and **Syalon 050** have to offer. Outlined above are just a few successful **industrial wear applications of Syalon**. Should you feel Syalon may be of benefit to your application please contact us.



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