



## t-ceramics Advanced Technical Ceramics

### Bisque Fired Machinable Ceramics 99.7% Alumina - Zirconia Toughened Alumina - Zirconia Silicate

## MACHINING INSTRUCTIONS

Thermansys is producing a broad range of machinable refractory ceramics for applications requiring ultra-high processing temperature, corrosion resistance, electrical and thermal insulation and high wear resistance. Machining can be accomplished in standard machine shops with lathes, milling machines, drills, saws etc. using conventional tooling. Available materials are **High Purity 99.7% Alumina, Zirconia Toughened Alumina (ZTA)** and **Zirconia Silicate (Zircon)**. All our material are offered in rods, hollow rods, bars and plates.

For detailed properties and delivery form please see our technical brochure "*Doc. No. : t-ceramics machinables-January 2017*"

**General Guidelines:** Handle parts carefully to prevent chipping or cracking. Place soft paper, cartons or other soft support sheets in between ceramic and machinery substrates for drilling or milling operations. When mounting rods on a lathe choke the use of a protective metal or plastic sleeve where the choke will apply pressure is recommended. Do not use pointed screws to hold parts. If the material will be fully fired after machining then calculate for the shrinkage. Shrinkage data and firing instructions for each material are given latter within this document.

**Dry machining:** Dry machining is producing better surfaces and closer tolerances. However dry operation is producing dust. Perform machining under suitable dust hood or absorber. Use vacuum cleaner if other means of dust collection are not available. Workers in all cases should be provided with suitable dust protection equipment. Clean thoroughly the machinery after each operation, ceramic dust is abrasive.

**Lubricant - Coolant:** Lubricants can be used mainly to avoid dust creation. Thermansys machinable ceramics processing will not produce much friction and thus cooling is not necessary. Only low concentration water soluble lubricants, or water, are recommended. Machinable ceramics are porous material and absorb liquid readily causing mechanical properties degradation. If lubricants are used keep their quantity as low as possible. When water based lubricant is used, dry out parts at 100-110 °C for 1-2 hours to remove residual moisture. Discoloration caused by the lubricant could be cleaned by firing up to 600 °C.

**Turning:** Use the same cutting speed and feed rates used for metals. Use Carbide or Silicon Carbide tools for better results. Keep tools sharp, dull tools will create chipping. It is recommended to use a protective metal or plastic sleeve between choke and ceramic cylinder to apply the pressure evenly. If this is not possible exercise care when mounting the part to the choke to avoid over tighten. Use low cutting depths, 2-4 mm maximum for external and internal diameters.

**Drilling - Milling:** Solid carbide drills and end mills, will give best results. However, standard general purpose quality tools for drilling and milling are also suitable. Keep tools sharp. Dully tools will create chipping. Avoid to drill directly to the final hole diameter. Drill gradually in 3-4mm diameter steps up to final diameter. For deep blind holes do not drill the entire depth once. Rise the drill every 6-8 mm depth and remove dust and chips from the hole. Flash with compressed air or use a vacuum cleaner to do so if necessary. Do not drill thru in order to avoid chipping from the exit side. For best results, work from one side, then rotate piece and work from the other side. Otherwise, place a piece of soft ceramic material on drill break-thru side or allow about 3-4 mm extra material for grinding cleanup. If the material will be fully fired after machining then calculate for the shrinkage.

**Tapping:** Use tungsten carbide tool bits and keep tools sharp. For internal threads, make clearance holes slightly larger than standard tap drill recommendations. If the material will be fully fired after machining then calculate for the shrinkage. Chamfer both sides of hole prior to threading to minimize chipping. Run the tap in one direction only as turning the tap

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back and forth can cause chipping. Perform threading with part turned upside down to allow for dust removal through gravity. If this is not possible flush with compressed air several times or use a vacuum cleaner to clean the threaded hole from dust.

**Cutting – Slotting:** Use sharp cutting tools, dull cutters may cause chipping. Carbide, Titanium coated or Tungsten and diamond bonded wheels are preferred but conventional tools can be used also for limited cuts. The wheel should cut steadily without dragging. Slotting can be accomplished with the use of end-mills also.

**Grinding – Polishing:** Heavy grinding is not recommended. Use Silicon Carbide grinding wheels for grinding at the recommended speeds. Use gradually grained Silicon Carbide abrasive papers to perform polishing to the desired degree.

**t-ceramics** is the brand name of refractory  
technical ceramics produced by  
**THERMANSYS**  
[www.thermansys.com](http://www.thermansys.com)

Thermansys is a producer of High Temperature Electrical Furnaces, Vacuum Ovens, Precision  
Vacuum Hot Plates and Refractory Technical Ceramics.

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