PDC DIAMOND PRODUCTS FOR FIXED CUTTER BITS
ROLLING CONE BIT COMPONENTS
PDC, MICROWAVE SINTERED WC/TSD
PDC AND CARBIDE WIRE
DRAWING DIE BLANKS
PDC DIAMOND RADIAL AND THRUST BEARINGS
Even at twice the load that produces galling and premature failure in ball bearings, diamond bearings continue to operate.

Diamond bearings begin with a lower friction coefficient that does not increase with rotation time.

Diamond bearings can withstand heat up to 1,600 degrees Fahrenheit.

Diamond bearings perform well in mud, air, or air mist environments.

Diamond bearings are not affected by contaminates in the lubricating system.
ERRATIC RESPONSE DUE TO BALL GALLING

BALL BEARING

PDC DIAMOND BEARING

MOTOR DIFFERENTIAL PRESSURE - PS I

TORQUE FOOT - LBS
SINTERED CARBIDE MICROGRAPHS at 1500X

MICROWAVE SINTERED

CONVENTIONALLY SINTERED
MW PROCESSES AND EQUIPMENT DEVELOPMENT

- Develop MW Applicators for Sintering Cemented Carbide and Other Materials
- Develop Basic Processing Parameters
- Manufacture MW Sintering Systems
- Service MW Equipment and Processes
The V Group - Inventors, Designers, Builders
SCHEMATIC OF AUTOMATED APPLICATOR

Crucibles Move from Top to Bottom and to Left
Crucibles move down and to the right through load lock.
Installed At Manufacturing Location
MW SINTERING
OF CARBIDE

- Volumetric Heating - Energy Transfer
- Sintering Time - Minutes
- Shrinkage - Uniform, Original Shape Maintained
- Uniform Melting - Co
- Grain Growth - Minimized
- Density - Theoretical
- Hardness - Equal or Better than Standards
ADVANTAGES OF MW SINTERED WC

- FINER GRAIN STRUCTURE
- NO GRAIN GROWTH INHIBITORS REQUIRED
- UNIFORM COBALT DISTRIBUTION
- IMPROVED ABRASION RESISTANCE
- IMPROVED EROSION RESISTANCE
- IMPROVED CORROSION RESISTANCE
- IMPROVED IMPACT STRENGTH
- MORE ENERGY EFFICIENT PROCESS
- LESS CAPITAL INTENSIVE
IMPROVED EROSION RESISTANCE OF MW SINTERED WC

MICROWAVE SINTERED

CONVENTIONALLY SINTERED
IMPACT TESTING
MW SINTERED VS. SINTER HIP

Impact Resistance vs Cobalt Content

Impact Energy at Fracture, J

%Co

NOTE: Curves assumed to reach the same low point at 0wt% cobalt, and to converge at high cobalt. Data from 6 wt% to 25 wt% cobalt are from real production parts; in some cases, pressed by the powder supplier, with microwave sintering the ONLY difference in the production sequence for the parts.
IMPROVED IMPACT STRENGTH OF MW SINTERED CARBIDE

MICROWAVE SINTERED

CONVENTIONALLY SINTERED
Granite Log Abrasion Tests
(20 passes using our standard conditions)

- MW Submicron Mahlonite - 15%Co - 15 vol% diamond
- HIP sintered-impreg - 15 vol% diamond (25/35 grit)
- MW sintered submicron carbide - no impreg - 10% Co
- Conv. sint. 6%Co - 1 micron WC
MICROWAVE SINTERED TSD INSERTS

ABRASION RESISTANT TSD MICROWAVE SINTERED IN TUNGSTEN CARBIDE

DTC PART# 12154
14.4mm DIAM x 12.7mm LONG
3 TSD ELEMENTS 4mmDIA
DUCTILITY AND STRENGTH OF MW SINTERED STEEL

Ductility test performed on a selected FC-0208 steel sample and microstructure before etching

Microwave and conventionally processed samples of hollow cylindrical shape (Fe-Cu-C steel) were tested for their ductility and toughness. Figure A and B shows the parts after load at failure. It was found that conventional part failed at a load of 320 lbs and microwave part at 430 lbs, an increase of about 30% in the strength. Also conventional part broke into 4 pieces (B) and the microwave part into two flat pieces (A) indicating higher ductility.

Pores in the microwave sintered samples have more rounded edges (C) in contrast to the sharp edges (D) in conventionally sintered sample. It is commonly known that sintered product exhibits an increasing ductility when the pore shape is more spherical.

Load at failure:

430 lbs

320 lbs

Microwave 1260°C - 20 min.
Conventional 1260°C - 20 min.
Ultra-hard diamond insert delivers efficient energy transfer for more controlled distance

Low friction polished diamond insert imparts minimal spin on ball for straighter shots