

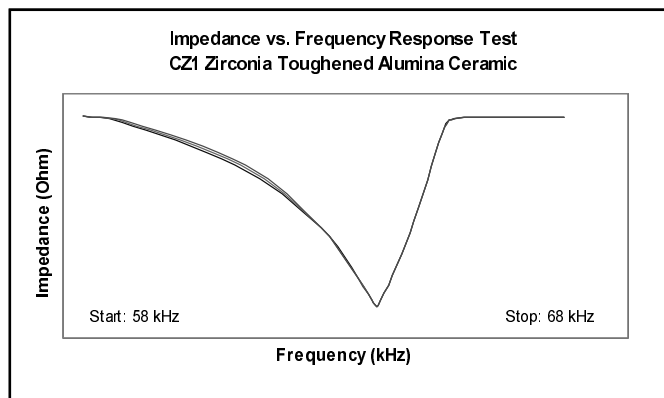
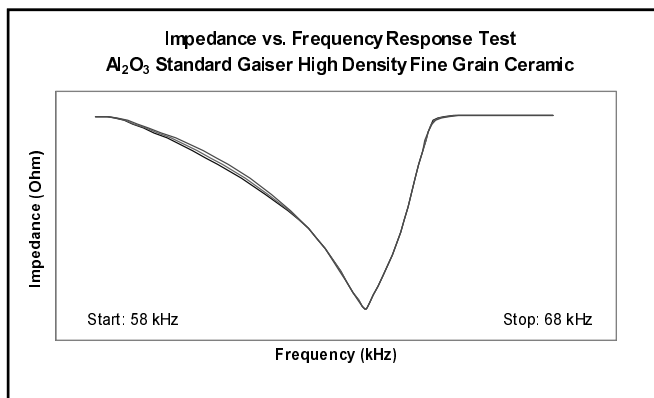
Gaiser Tool Company's CZ1 Material Ultrasonic Analysis
CZ1 Zirconia Toughened Alumina vs. Standard Al₂O₃ Alumina Ceramic
60 kHz Ultrasonic Test Data



Gaiser Tool Company has developed our new CZ1 Zirconia Toughened Alumina for use on tough and abrasive lead frame surfaces such as NiPd, and as a high-strength material for very small Angle Bottle-neck capillaries. This new material has proven

itself to be more resistant to wear and to provide improved shear strength for Angle Bottle-necks. The following tests show that the CZ1 material is ultrasonically transparent when compared to conventional Al₂O₃ Alumina Ceramic material.

The graphs below represent the Impedance of the Capillary vs. the Frequency Response. The minimum impedance is the point of maximum resonance of the capillary. The transducer automatically searches for the point of maximum resonance near the rated frequency, and performs the wire bond at this point. The graphs indicate strong distinct points of resonance, with no secondary resonances in the frequency search range of the transducer. Secondary resonances can confuse the transducer, and result in inconsistent wire bonds. Both the Al₂O₃ and the CZ1 have virtually identical ultrasonic impedance vs. frequency responses, making the CZ1 material ultrasonically transparent to the conventional ceramic.



Impedance vs. Ultrasonic Power Test Standard Al ₂ O ₃ Fine Grain Ceramic		
Resonance Freq. (Hz)	Impedance (Ohm)	Power (mWatt)
62840	15.00	140
62840	15.00	221
62840	15.00	318
62840	15.00	429
62840	15.00	546
62820	16.00	765
62820	15.00	930
62820	15.00	1098
62820	16.00	1268
62800	16.00	1608

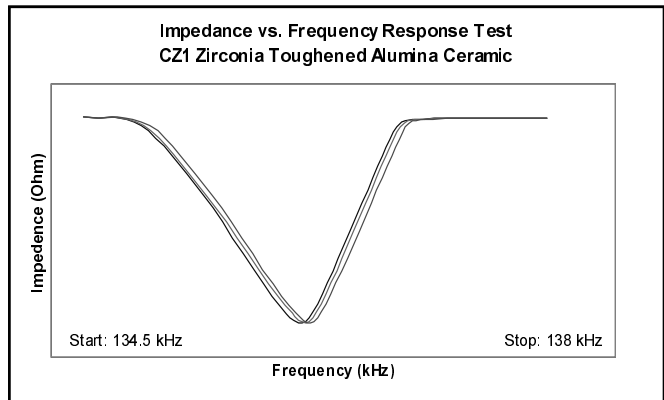
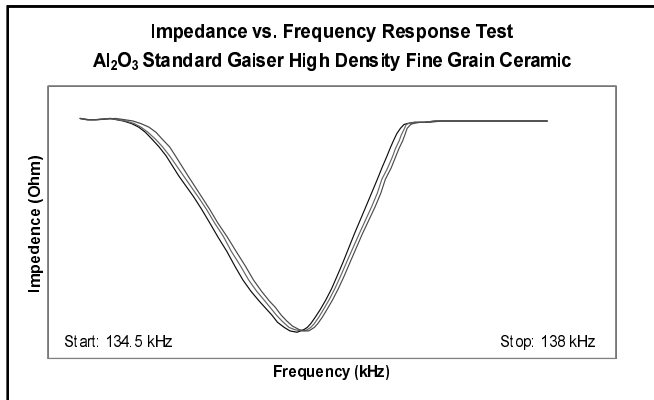
Impedance vs. Ultrasonic Power Test CZ1 Zirconia Toughened Alumina Ceramic		
Resonance Freq. (Hz)	Impedance (Ohm)	Power (mWatt)
62800	15.00	139
62800	15.00	218
62800	15.00	314
62800	15.00	424
62800	16.00	540
62780	16.00	755
62780	16.00	920
62780	16.00	1090
62780	16.00	1264
62780	16.00	1440

The charts above represent the Impedance of the Capillary vs. the Ultrasonic Power as the power level is increased from near zero to 1500 mWatts. The test is performed at ten separate power sweeps at increasing power levels. The resonate frequency and the capillary impedance are recorded for each power level. An impedance range variation of ≤ 3 ohms indicates that the capillary is linear in its transfer of ultrasonic energy as the power is increased. A capillary with good linearity indicates that it efficiently transfers ultrasonic energy at all ultrasonic power settings. High ultrasonic efficiency results in effective and consistent wire bonding at varying ultrasonic power levels.

Gaiser Tool Company's CZ1 Material Ultrasonic Analysis
 CZ1 Zirconia Toughened Alumina vs. Standard Al₂O₃ Alumina Ceramic
 138 kHz High Frequency Ultrasonic Test Data



The graphs below represent the Impedance of the Capillary vs. the Frequency Response. The minimum impedance is the point of maximum resonance of the capillary. The transducer automatically searches for the point of maximum resonance near the rated frequency, and performs the wire bond at this point. The graphs indicate strong distinct points of resonance, with no secondary resonances in the frequency search range of the transducer. Secondary resonances can confuse the transducer, and result in inconsistent wire bonds. Both the Al₂O₃ and the CZ1 have virtually identical ultrasonic impedance vs. frequency responses, making the CZ1 material ultrasonically transparent to the conventional ceramic.



Impedance vs. Ultrasonic Power Test Standard Al ₂ O ₃ Fine Grain Ceramic		
Resonance Freq. (Hz)	Impedance (Ohm)	Power (mWatt)
136700	14.00	133
136720	14.00	190
136700	14.00	282
136660	15.00	430
136660	15.00	526
136640	15.00	679
136620	15.00	889
136620	15.00	1020
136620	15.00	1151
136620	15.00	1282

Impedance vs. Ultrasonic Power Test CZ1 Zirconia Toughened Alumina Ceramic		
Resonance Freq. (Hz)	Impedance (Ohm)	Power (mWatt)
136640	15.00	132
136620	15.00	204
136600	15.00	294
136600	15.00	371
136600	15.00	456
136540	16.00	671
136560	15.00	751
136500	16.00	1054
136500	16.00	1183
136480	16.00	1390

The charts above represent the Impedance of the Capillary vs. the Ultrasonic Power as the power level is increased from near zero to 1300 mWatts. The test is performed at ten separate power sweeps at increasing power levels. The resonant frequency and the capillary impedance are recorded for each power level. An impedance range variation of ≤ 3 ohms indicates that the capillary is linear in its transfer of ultrasonic energy as the power is increased. A capillary with good linearity indicates that it efficiently transfers ultrasonic energy at all ultrasonic power settings. High ultrasonic efficiency results in effective and consistent wire bonding at varying ultrasonic power levels.

Test Details: The Gaiser capillaries were tested by Uthe Technology, Inc. located in Milpitas, California. The tests were performed using Uthe Technology proprietary transducer/capillary testing software and measurement devices.

Conclusion: The CZ1 Zirconia Toughened Alumina ultrasonic performance is transparent as compared to conventional Gaiser high density fine grain Al₂O₃ alumina ceramic as shown in the Impedance vs. Frequency Response tests and the Impedance vs. Ultrasonic Power tests. The data for the capillary samples reflects good ultrasonic characteristics and there is no significant difference in the ultrasonic characteristics of these capillaries as indicated by these tests.

