

## **PROCESS COMPENSATED RESONANT TESTING**

### ***Solutions – Ceramics***

Quasar is used to test a wide range of ceramic parts. Applications include:

- Oxygen sensors,
- Catalytic converter cores, and
- Grinding wheels.

#### **Quasar detects all structurally significant defects**

Quasar detects all of the structural defects that occasionally appear in ceramic parts including:

- Cracks
- Chips
- Inclusions
- Incomplete sintering
- Incorrect powder mixture

#### **Quasar provides better NDT**

Since a part's resonance pattern provides a measure of the structural integrity of the whole part, a single Quasar test can replace other NDT methods that typically focus on specific defect types. Quasar replaces the dye penetrant used for cracks. It also replaces, or compliments, visual inspections for chips and significant dimensional variations, and it can detect inclusions or incomplete sintering that are sometimes detected using candling. Quasar can also replace many of the lab tests used to confirm correct density, sintering and powder mixture.

#### **Special Considerations**

Quasar testing can be used for materials that are stiff enough to resonate. While Quasar can be used with most ceramic parts after complete sintering, it cannot be used in the green state. Using Quasar for partially sintered parts is generally problematic because the parts are so soft that they do not resonate well.

Quasar testing will only detect structurally significant defects, that is, defects that are severe enough to cause a part to fail prematurely in service. So Quasar will not detect surface crazing that does not weaken the part.

In applications to symmetrical ceramic parts such as balls and rollers, Quasar can use an alternate resonance testing method based on the symmetry of the part. This method is somewhat less sensitive to defects than Quasar's pattern recognition method, but it has the advantage that it is not statistics-based, so the presence of defects can often be

determined without the need for training of the computer algorithm using a Training Parts Set.

### Benefits

The benefits of using Quasar for ceramic include:

- Reliable detection of all structurally significant defects in a single test
- Results that can predict road life by correlating to failure testing (e.g., tensile or fatigue tests)
- Computer based accept/reject decisions, not subject to human judgment
- Reduction in scrap as cosmetic defects are not rejected
- Dry, non-magnetic process eliminates need for post-inspection treatment

## ***Ceramics Economic Case Study***

### Description

The part is a ceramic oxygen sensor tested at 1000 parts per hour. The plant operates 3 shifts per day, 5 days per week and produces 5,000,000 sensors per year. The plant is located in the US and all costs and prices are in US\$.

<b>Part</b>	Oxygen Sensor
<b>Method</b>	Ceramic
<b>Part Numbers</b>	1
<b>Quasar NDT</b>	3100
<b>Loading</b>	Manual
<b>Location</b>	US
<b>Amortization</b>	2 years
<b>Payback</b>	6 months

Quasar allows the current inspection regime to be modified as follows:

- Eliminate 5000 psi “proof test”

The Quasar system consists of 3 manually loaded Quasar 3100 NDT Systems. The total price was \$300,000. The cost savings are tabulated below.

<b>Quasar cost / part</b>	\$	0.03
<b>Proof cost / part</b>	\$	0.15
<b>Savings / part</b>	\$	0.12
<b>Payback parts</b>		2,500,000
<b>Payback months</b>		6

The Quasar cost per part is based on capital amortization over 2 years. It does not include labor because the Quasar load/unload operation is incorporated into the existing operator cycle, with no added manpower. In addition to the reduced NDT cost, the scrap rate was substantially reduced for additional savings. More important, the number of defective sensors received by the ultimate customer was reduced by a factor of 40.