MISTRAS
A World of NDT Solutions
Products & Systems Division

Application Brief

M100A: Powder Metal Applications

The Metal Inspector Model 100 uses resistivity, a basic principle of electronics, to quickly and accurately determine the quality of powdered metal parts. Test results indicate that the Metal Inspector can accurately measure density variations in either compacted (non-heated) or sintered (heated) parts. It can also be used to inspect parts for cracks and/or excessive porosity. The Metal Inspector's combination of speed, precision, versatility and low cost, when compared with other nondestructive testing methods, makes it a highly practical and desirable alternative.

How it Works

The Metal Inspector pulses a precise, direct current into metal through a trigger-activated, 4-point probe. Unlike other nondestructive testing methods, no preparation is required. The rapidly reversing impulse measures the metal's resistivity (to the flow of the electrical current) and instantly displays it as a simple digital readout. Resistivity can then be correlated to the density of the material. Variations in resistivity within a given part or from part to part provide the user with immediate numerical data that can be correlated to part quality.

Measuring Density

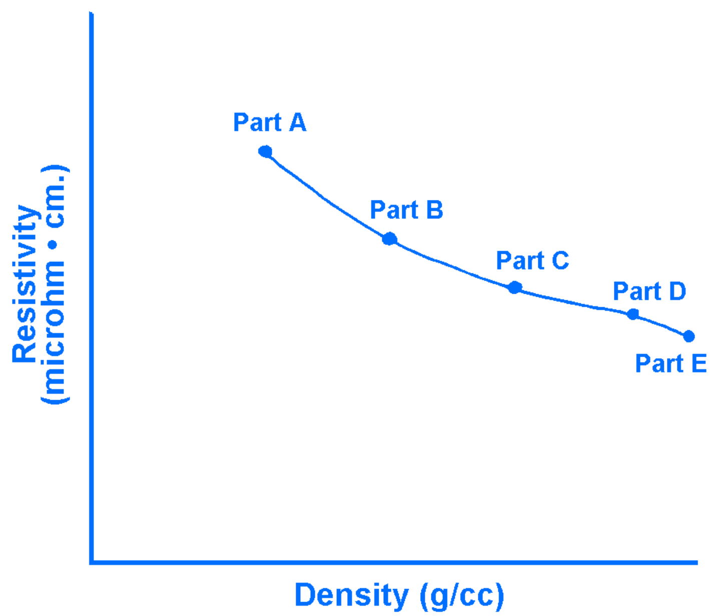
The quality and integrity of a P/M part, either after compaction or sintering, depends on how tightly packed, or dense, the particles become. Here's where the Metal Inspector comes in. The more densely packed the particles are, the less resistance the electrical current encounters as it flows through the metal. The greater the density of particles, the lower the measured resistivity.

Greater Density = Lower Resistivity

Sintered powder metal parts, with known densities, were tested to demonstrate the inverse relationship between density and resistivity. See Table A.

Sample Part	Relative Part	Density Resistivity
A	5.87g/cc	20.6
B	6.32g/cc	18.1
C	6.63g/cc	16.4
D	7.08g/cc	15.0
E	7.22g/cc	14.8

The resistivity of each part was determined by the average of five individual readings with our Metal Inspector using a 100-mil probe. See Graph 1.

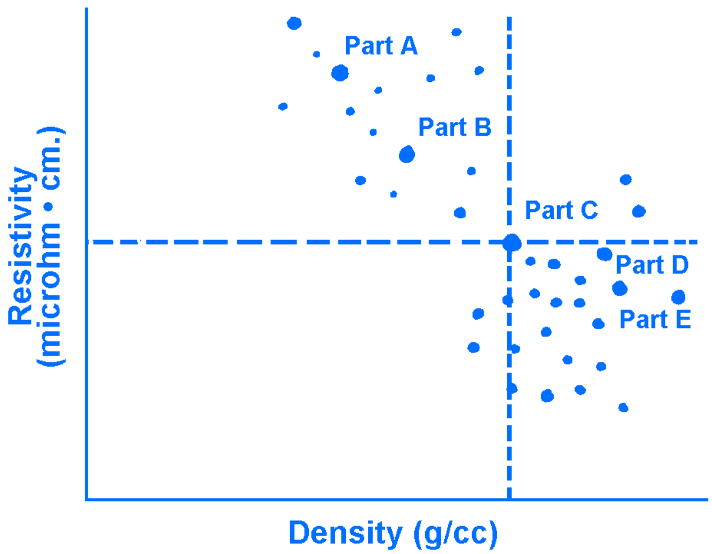


Graph 1

Relative Testing of Parts

This principle can be applied to batch testing of many parts if a density “cutoff” is predetermined. Measure the density of a uniform, acceptable part and take a resistivity reading with the Metal Inspector. This is your “base” reading. Now start testing other parts from the same batch. All parts that display resistivities below the “base” or “cutoff” should have acceptable density. Parts with resistivities higher than the “base” indicates unacceptable densities. Remember, the lower the resistivity, the higher the density, and vice-versa.

(See Graph #2.)

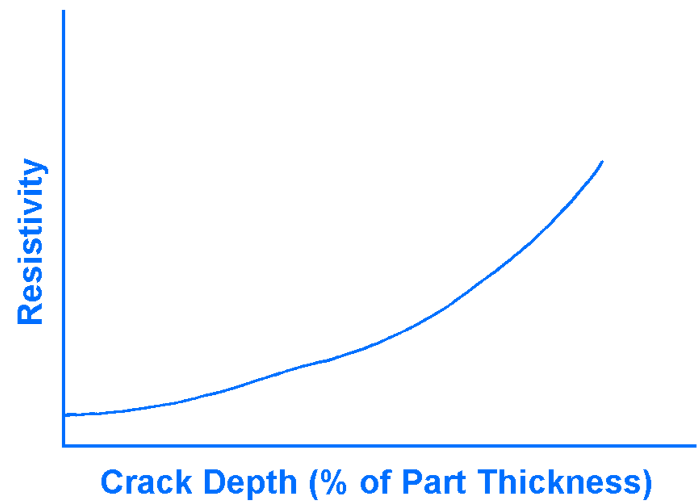


Graph 2

Note: If Part C was the standard to which all other parts was compared, a correlation graph might look like this.

Cracks/Excessive Porosity = Higher Resistivity

The Metal Inspector can also be used to find cracks and excessive porosity. Because cracks and pores represent air spaces in metal, they are nonconductive and increase resistivity readings. Graph #3 shows the approximate rate of increase in resistivity as crack depth increases. The curve is independent of material type and is based on the relationship of probe spacing (s) and material thickness (t).



Graph 3

For assistance contact us at 609-716-4000, fax: (609) 716-0706, or e-mail us at sales.systems@mistrasgroup.com.

195 Clarksville Road, Princeton Junction, NJ 08550 USA
Phone: (609) 716-4000 • Fax: (609) 716-0706
Email: sales.systems@mistrasgroup.com • www.mistrasgroup.com