Technologies to Products…On the Leading Edge

# NanOxide™ HPB-1000 <100nm Barium Titanate

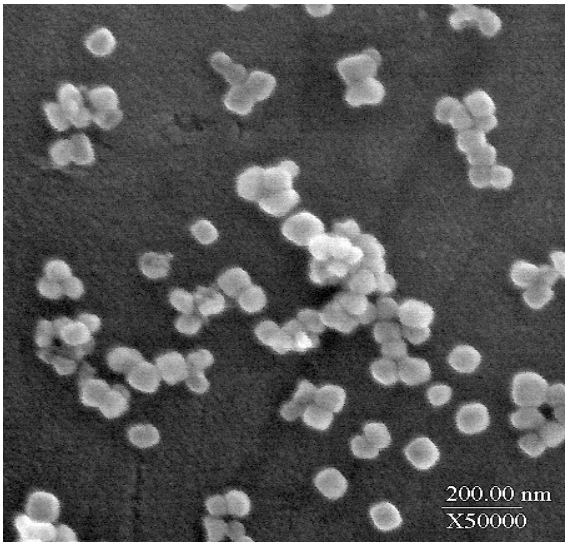
TPL's NanOxide™ is a chemically precipitated high purity barium titanate designed to meet a variety of demanding electronics applications. HPB-1000 has an extremely tight particle size distribution and is the smallest commercially available barium titanate on the market.

It is recommended for dielectric applications in the form of ceramic tapes, monolithic capacitors, and composites.

## Typical Properties

HPB-1000 is a crystallographically cubic, phase pure barium titanate.

| | |
|---|---|
| Specific Surface Area | 15-18 $m^2/g$ |
| Nominal Size | 50 nm (BET) |
| Loss On Ignition | <1.5% |
| pH (ASTM - D1208) | 9.0-11.0 |
| Chemical Analysis | |
| Ba:Ti (XRF) | 0.995-1.010 |
| SrO (ICP) | <0.1% |
| CaO (ICP) | <10 ppm |
| MgO (ICP) | <10 ppm |
| $SiO_2$ (ICP) | <200 ppm |
| $Al_2O_3$ (ICP) | <100 ppm |
| $Fe_2O_3$ (ICP) | <10 ppm |
| $BaTiO_3$ | >99.5% |



# Applications

HPB-1000 is finding use in multilayer multi-layer ceramic capacitors (MLCC), monolithic ceramic capacitors, polymer-ceramic composites, electrode pastes and piezoelectric devices

# Processing

When introducing HPB-1000 into your process, please keep the following points in mind:

- The manufacturing process for barium titanate includes a drying step which induces soft agglomeration (roughly 75 micron size particles). These agglomerates are easily broken up by ultrasonication or ball milling.
- Some harder agglomerates will also exist in the powder comprising several to tens of particles. Because of the extremely fine particle size, these agglomerates require more energy than is traditionally required for larger, micron sized particles. In other words, when switching from micron sized powder to nano-sized powder it may be necessary to lengthen ball milling time by a factor of two or three.
- Because of the extremely high surface area, higher surfactant concentrations are typically necessary to disperse nano-sized barium titanate relative to micron sized powder.

TPL, Inc. markets a formulated dispersing agent, NanoSperse™ 484, specifically designed to enhance dispersion of NanOxide™ ceramic powders in both aqueous and organic solvents.

TPL, Inc. has considerable experience with slurry production, tape cast compositions, composite formulations, dry pressing and firing operations. We are happy to assist you in determining a process for your application.

**For more information, contact:**
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