HORIBA Scientific

Application Note

Boron Carbide
ADS121

Particle Size Analysis of Boron Carbide

Introduction

Boron carbide (B_4C) is one of the hardest materials known, after diamond and cubic boron nitride, and the hardest material produced in tonnage quantities. Due to its high hardness, boron carbide is used in many abrasive applications or to make highly abrasion-resistant parts such as nozzles. Its ability to absorb neutrons without forming long lived radio-nuclides make the material attractive as an absorbent for neutron radiation arising in nuclear power plants. The combination of high hardness, high elastic modulus, and low density makes boron carbide attractive for use in ballistic body armor.

As with other non-oxide materials, boron carbide is difficult to sinter to full density, with hot pressing or sinter HIP being required to achieve greater than 95% of theoretical density. Small quantities of dopants such as fine carbon or silicon carbide are usually required to achieve sintering at realistic temperatures (e.g. 1900 - 2200°C).

The particle size distribution of the boron carbide powder affects the manufacturing and mechanical properties of these components, including packing density and mechanical strength of the final part. The example data shown to the right was measured on the HORIBA Partica LA-960. To assure dispersion of agglomerates for testing, these materials are usually dispersed in water for measurement, with a non-ionic surfactant added to prevent agglomeration.

Analytical Test Method

Refractive Index (particle): 2.66

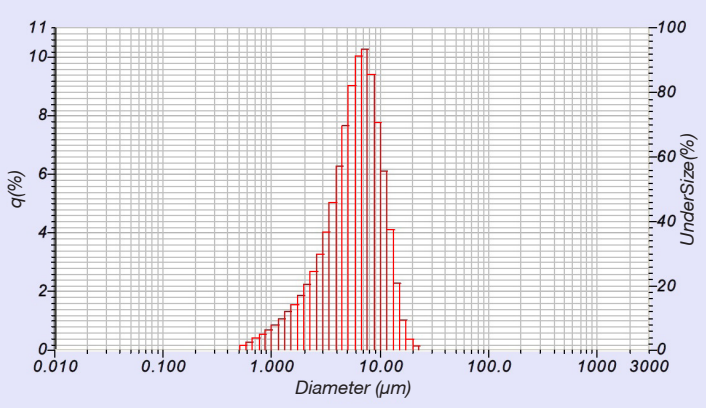
Dispersant fluid: Water, 0.1% Igepal 630 surfactant

Sonication: 4 minutes, power 1

Circulation speed: 3

Agitation speed: 1, continuous

Notes: Pre-dispersion with concentrated surfactant may be necessary to wet the particle surface before adding to the dispersion fluid.



Example data

File Name:	6473
Median:	5.972 µm
Mean:	6.357 µm
S. D.:	3.418 µm
D(10%):	2.161 µm
D(90%):	11.010 µm

Results

Dispersion and analysis of boron carbide is straightforward with relatively easy dispersion and good stability once dispersed. The built-in ultrasonic probe of the Partica LA-960 was useful to eliminate external preparation steps and the stability of the optical system provides very reproducible results.