

FEBRUARY
1991

AMERICAN
CERAMIC
SOCIETY
BULLETIN

ACSBAT

COMPOSITES
TECHNOLOGY

SiC Whisker
Characterization

Update on
Glazing
Technology

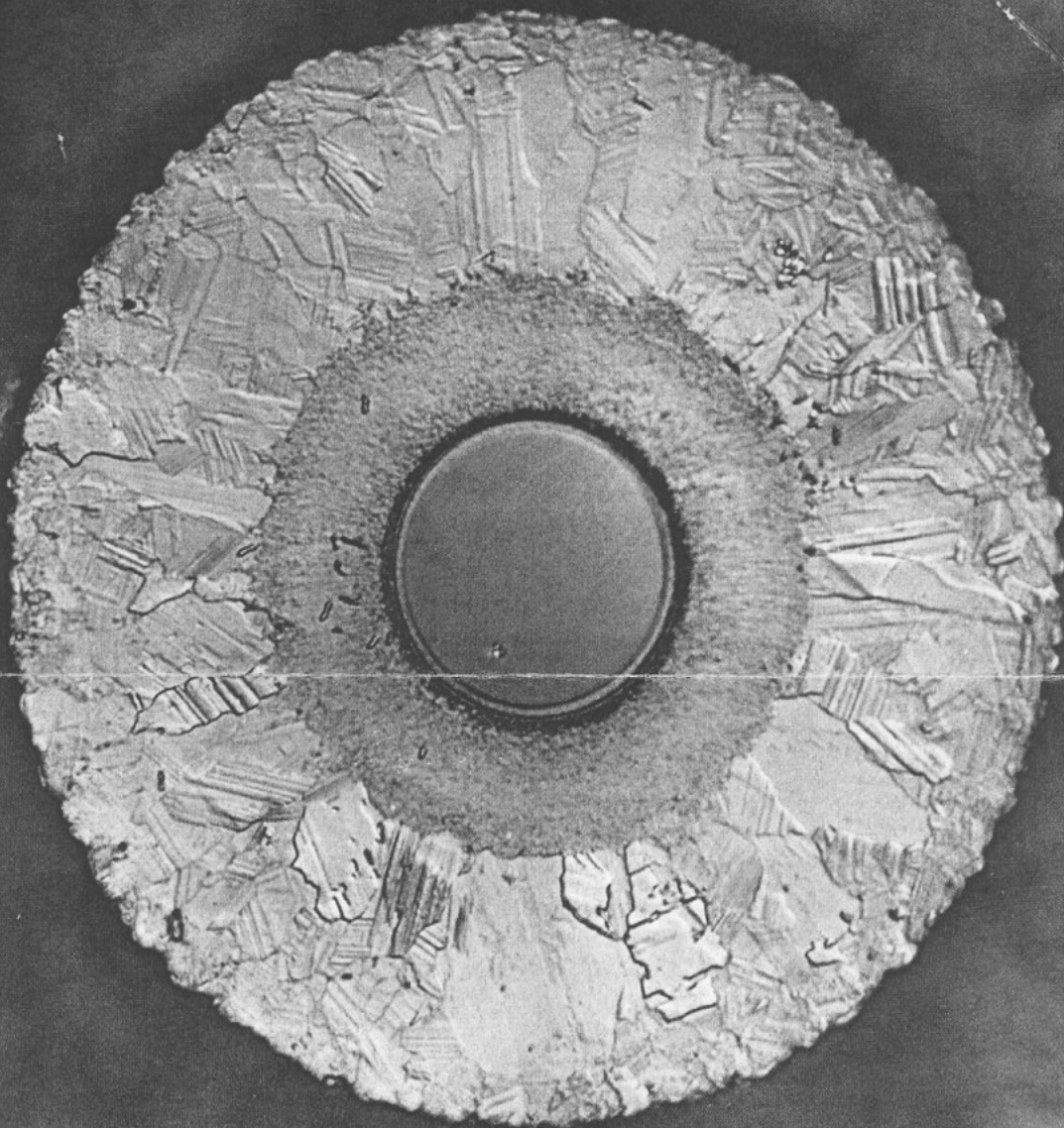
Advanced
Materials
Information
Needs

Belite Cements

Protecting
Patents

Combustion
Synthesis

THE AMERICAN CERAMIC SOCIETY BULLETIN, VOL. 70, No. 2, PP. 153-272, FEBRUARY 1991



The
American
Ceramic
Society
Inc.



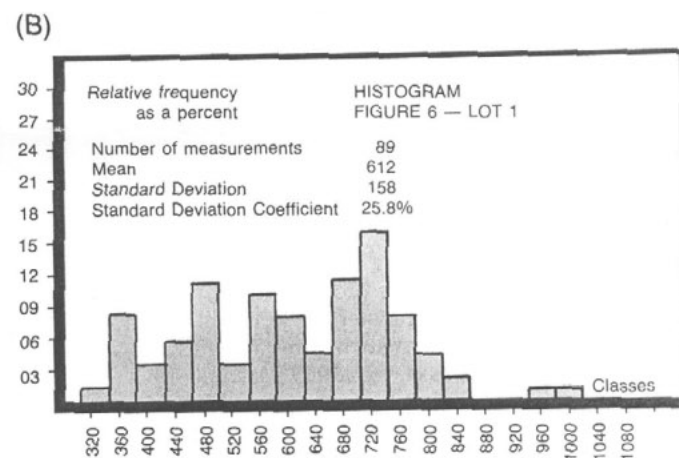
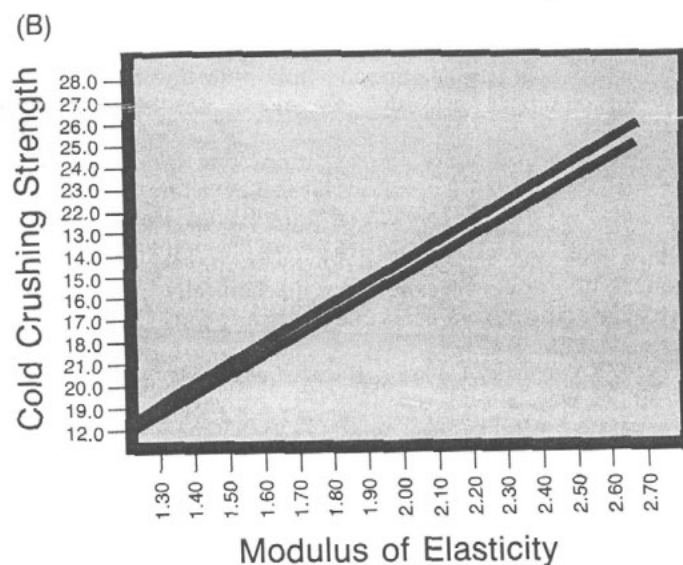
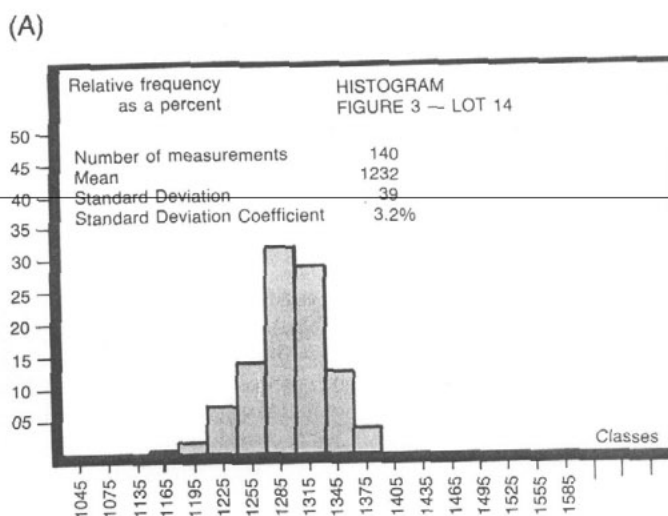
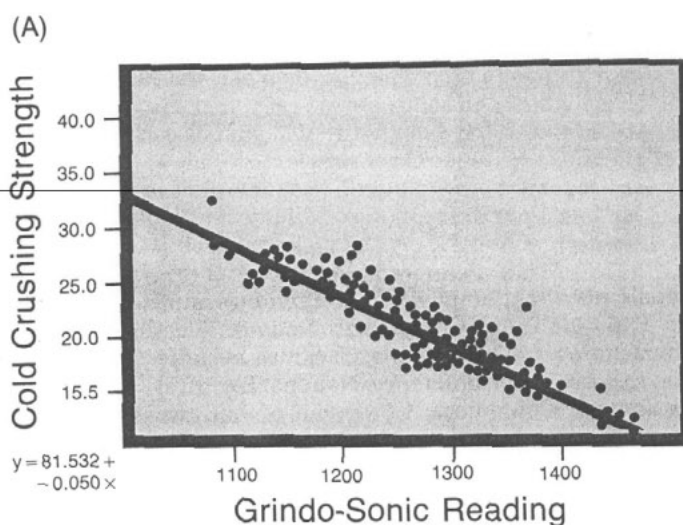
Resonant frequency testing for refractories

With the goal of improving the testing of refractory products and materials, the Minerals and Refractories Laboratories (MRL) of France has investigated a method that is nondestructive, quick, easy to use, and economical. The method uses an instrument originally developed to determine the modulus of elasticity of grinding wheels. This instrument, called the Grindo-Sonic, makes use of the impulse excitation principle, rather than continuous excitation. A test object is excited by means of a light mechanical impulse. The resulting relaxation will take the form of a damped vibration, which depends on the nature of the material, as well as the geometry and mass of the test piece.

The vibration picked up by the detector and initially amplified, is analyzed by an electronic circuit in order to select the fundamental mode from what is generally a rather complex vibration spectrum. The instrument measures the frequency of this fundamental vibration. It consists of two types of probes to detect the vibrations and electronic measurement circuits. The direct contact probe is used most often and consists of a piezo-electric crystal and a two-stage pre-amplifier. The microphone probe is used for very small samples and in automated test setups.

In the first stage, MRL collected data over several years and established correlations for cold mechanical strength for shaped isolation products. During the second stage, MRL investigated the existing relationship between the modulus of elasticity and the cold crushing strength for the same bricks. MRL also determined that the instrument can be applied to other applications. This technique can give accurate, nondestructive results on product quality, immediately upon reception of the lot. More specifically, the measurement indicates production and delivery homogeneity which can be an important factor in choosing a supplier. The technique also allows a manufacturer to accurately monitor production and to quickly determine possible degradation.

For certain products, clear correlations have been established between mechanical properties at room temperature and the modulus of elasticity. Work is continuing to establish if correlations exist with bending strength at elevated temperatures, and thermal shock resistance. These will be related to wear rate under different loads and breaking loads, as well as breaking strength under flexure. For further information on the Grindo-Sonic, contact J.W. Lemmens Inc., 10801 Pear Tree Lane, St. Louis, MO 63074-1450, 314-427-3884.



Cold crushing strength has been found to correlate to the resonant frequency test, A. This strength also correlates well with the modulus of elasticity, B.

Plotting relative frequency histograms can indicate the quality of each lot. The shape is normal when the production lot is homogeneous, A, and has no shape at all if the lot is very inhomogeneous, B.