ADVANCED THERMAL PROPERTIES OF REFRACTORIES

July 6, 8, 13, and 15, 2021

11:00 to 3:00 p.m. EDT (lunch break from 12:30-1:30)

COURSE OUTLINE

Advanced Thermal Properties of Refractories

July 6

- Thermal Stability
    - Definition
    - Thermodynamic Principles
    - Chemical Bonding
    - Application to Refractories
        - Melting Temperature vs. Free Energy of Formation Diagrams
- Heat Capacity
    - Definition
    - Dulong and Petit Model
    - Einstein Model
    - Debye Model
    - Electronic Contributions
    - Structural Aspects of Heat Capacity
    - Application to Refractories
    - Measurement Technique and Laboratory Demonstration
        - ASTM E1269 Heat Capacity by Differential Scanning Calorimetry

July 8

- Thermal Conductivity
    - Definition
    - Phonon Conductivity
    - Structural Aspects of Phonon Conductivity
    - Photon Conductivity
    - Structural Aspects of Photon Conductivity
    - Application to Refractories
    - Measurement Techniques and Laboratory Demonstrations
        - ASTM C201 Thermal Conductivity of Refractories by Water Calorimeter
        - ASTM C1113 Thermal Conductivity of Refractories by Hot Wire
        - ASTM E1461 Thermal Diffusivity and Conductivity by Laser Flash

July 13

- Thermal Expansion
    - Definition
    - Bonding and Potential Energy
    - Equation of State of Solids
    - Structural Aspects of Thermal Expansion
    - Application to Refractories
        - Reversible Changes
        - Irreversible or Permanent Changes
    - Thermal Conductivity-Thermal Expansion Relations
    - Measurement Technique and Laboratory Demonstration
        - E228 Thermal Linear Analysis

July 15

- Thermal Shock
    - Definition
    - Thermal Stresses
        - Thermal Expansion Mismatches
        - Temperature Gradients
    - Thermal Shock Theory
        - Thermoelastic Theory
        - Damage Resistance Theory
    - Application to Refractories
    - Measurement Technique and Laboratory Demonstration
        - ASTM C1171 Quantitatively Measuring the Effect of Thermal Cycling on Refractories