



Introduction to Refractories: Course Outline

Learn the fundamentals of all classes of refractories and their applications

This course addresses most of the significant topics in the field of refractories, both theoretically and experimentally. The lectures follow the natural evolution of refractories from their mineral and synthetic origins, to their chemical, mineralogical, and microstructural constitution, and their application, installation, and degradation in service. The sessions are also designed to give the participants knowledge of common refractory testing techniques. The individual sessions are titled in the accompanying outline of the daily topics.

<u>Class Dates</u>	<u>Topics / Activities During Class</u>
Lecture 1	<ul style="list-style-type: none"> • Introduction to Refractories • Thermal Properties <ul style="list-style-type: none"> ○ Volume Stability <ul style="list-style-type: none"> ▪ Reversible Changes ▪ Irreversible or Permanent Changes ○ Heat Capacity ○ Thermal Conductivity
Lecture 2	<ul style="list-style-type: none"> • Mechanical Properties <ul style="list-style-type: none"> ○ Elasticity ○ Brittle Fracture ○ Creep
Lecture 3	<ul style="list-style-type: none"> • Thermomechanical Properties <ul style="list-style-type: none"> ○ Thermal Stresses ○ Thermoelastic Theory ○ Thermal Shock Damage Resistance Theory • Corrosion Properties <ul style="list-style-type: none"> ○ Fundamental Principles of Liquid-Solid Corrosion ○ Liquid Phase Formation <ul style="list-style-type: none"> ▪ Wetting ▪ Phase Equilibrium Diagrams
Lecture 4	<ul style="list-style-type: none"> • Silica Refractories <ul style="list-style-type: none"> ○ Raw Materials – Silica ○ Phase Relationships ○ Processing ○ Microstructure/Properties • Alumino-Silicate Refractories <ul style="list-style-type: none"> ○ Raw Materials – Alumina-Silica ○ Phase Relationships ○ Processing ○ Microstructure/Properties
Lecture 5	<ul style="list-style-type: none"> • Basic Refractories <ul style="list-style-type: none"> ○ Raw Materials – Magnesite, Dolomite, Chrome-Magnesite, Forsterite, Spinel ○ Phase Relationships ○ Processing ○ Microstructure/Properties • Insulating Refractories



	<ul style="list-style-type: none"> ○ Insulating Firebrick <ul style="list-style-type: none"> ▪ Processing ▪ Microstructure/Properties ○ Insulating Fibers <ul style="list-style-type: none"> ▪ Processing ▪ Microstructure/Properties
Lecture 6	<ul style="list-style-type: none"> • Monolithic Refractories <ul style="list-style-type: none"> ○ Raw Materials – Hydraulic Cement, No Cement, Chemical Binders ○ Phase Relationships ○ Processing ○ Microstructure/Properties • Non-Oxide Refractories <ul style="list-style-type: none"> ○ Raw Materials – Carbon, Silicon Carbide, Silicon Nitride ○ Phase Relationships ○ Processing ○ Microstructure/Properties
Lecture 7	<ul style="list-style-type: none"> • Composite Refractories <ul style="list-style-type: none"> ○ Raw Materials – Magnesia-Carbon, Alumina-Silicon Carbide-Carbon, AluminaCarbon ○ Processing ○ Microstructure/Properties • Special Refractories <ul style="list-style-type: none"> ○ Raw Materials – Zirconia, Zircon, Fusion Cast – Alumina-Zirconia-Silica, Alumina, Alumina-Chrome, Magnesia-Chrome ○ Phase Relationships ○ Processing ○ Microstructure/Properties
Lecture 8	<ul style="list-style-type: none"> • Design of and with Refractories <ul style="list-style-type: none"> ○ Microstructural Design ○ Process Vessel Design • Applications of Refractories <ul style="list-style-type: none"> ○ Iron and Steel ○ Non-Ferrous Metals ○ Ceramics ○ Glass ○ Minerals Processing ○ Chemicals