## Non-Metallic Materials

- Pottery
- Ceramics
- Glass
- Rubber
- Plastic
- Adhesives
- Explosives

### Pottery & Ceramics

#### Dawn Of Civilization (Pre 6000 BC)
- Baked In The Sun Or Camp Fires

#### Clay
- Primarily Hydrated Aluminum Silicates
- Also Alkalis, Alkaline Earths, & Iron Oxides (Red)
- Plastic When Wet

#### Procedure
- Mix Clay With 8-15% Water & Then Form
- Dry & Fire Object At 450-750°C To Drive Off Water
- Higher Temps Cause Clay To Vitrify & Fuse
  - Red, Ashed, In Ancient Times

### Pottery & Ceramics (Continued)

#### Egypt & Mesopotamia
- Potter’s Wheel
- Kiln
  - Fueled With Wood, Or, Charcoal
  - Reached Temperatures Of 1000°F

#### Glazing
- Substances Which Turn To Glass After Firing
  - Egyptians Blue Glass
    - White, Sand, Potash, Limestone, Copper (Blue)
  - Assyrians (700 BC)
    - Lead-Rich, Lime, Chalk (Yellow)
  - Greeks (500 BC)
    - Black & Red Glaze

### Pottery & Ceramics (Continued)

#### Luster Ware
- Middle East (800s)
- Spain (1300s)

#### Procedure
- Powdered Soaps, Of, Copper, & Silver, Applied To An Object With A Thimble Glaze
- Rusted To Leave A Lustrous Layer, Of, Copper, & Silver
- Italy - Majolica (1400s - 1500s)
- Applied, Tin-Lead Glazes To Sculptures

### Pottery & Ceramics (Continued)

#### Chinese Porcelain
- Constituents
  - Infusible - Kaolin (China Clay)
  - Fusible - Vitreous, Of, Feldspar, Clay, & Quartz
- Fired At 1400°C
- Various Colors (Blue From Cobalt)
  - Imported, From, Persia, (14th & 15th Centuries)
- Earliest Porcelain
  - Sung Dynasty, (960 – 1127)
- Glorious Perfection (Ming Vases)
  - Ming Dynasty, (1368 – 1644)
Pottery & Ceramics (Continued)

European Porcelain
- Tried To Duplicate Chinese
- Needed Kaolin (China Clay)
- Porcelain Halfway Between Pottery & Glass
- German Johann Friedrich Bottger (Early 1700s)
  - Bred, Kaolin, Sand, Al. Silicate, Powdered, & Fused
- England (Mid To Late 1700s)
  - Powdered Glass & White Clay
- Josiah Wedgewood
  - Added, Crushed Flint, 1 Pt. to 22 Parts White Clay
  - White Throughout, Object
  - Pioneered Steam In Pottery Industry, (1789)

Ceramics

Greek “Kerameikos" - Potters Quarter Of Athens
- Articles Made By Forming & Firing Clay
- Modern Definition
  - Any Inorganic Substance Which, When Melted, Attains The Familiar Rock-Like Hardness
- Properties
  - Mechanical - Thermal & Compressive Strength
  - Weathering
  - Electrical - Insulators & Resistors

Uses

- Bell-Shaped Insulators For Telegraph (1850s)
- Lined Vessels - Acids
- Iron & Steel Industries
  - Magnesite, Drifts
  - Bessemer, Steel Forger
  - Babolite, Lined Vessel

Ingredients

- Sand (35 Parts) - Silica (Quartz Or Crushed Flint)
- Soda Ash (5 Parts) - Fern Plants
- Lime (4 Parts)

Procedure

- Melt Inorganic Substances
- Cool Without Allowing Crystallization
  - Molds, Bowl, Arrange In Regular Patterns
- Produces Rigid Liquid (Not A Solid)

Pottery & Ceramics (Continued)

Glass

Filaments

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- Lined Vessels - Acids
- Iron & Steel Industries
  - Magnesite, Drifts
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Chinese

- Magnifying Glasses (10th Century)

Italy

- Spectacles For Long Sight (13th Century)

Telescope

- Johannes Lippershey - Netherlands (1608)
- Galileo (1609)

Microscope

- Anton van Leeuwenhoek (1590)
  - Robert Hooke (Mid 1600s)
    - First, Compound, Microscope

Glass (Continued)

Primitive Man
- Obsidian - Glassy Volcanic Rock
- Egypt (4000 BC)
  - Colored Opaque Glaze On Beads
- Roman Empire
  - Blowing Iron (1st Century BC)
- Britain
  - George Ravenscroft (1673)
    - Lead Glass (Ceramit)
    - Added Lead, Silver
    - Heavy, With High Refraction, Index

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