LESSON 10 CERAMICS

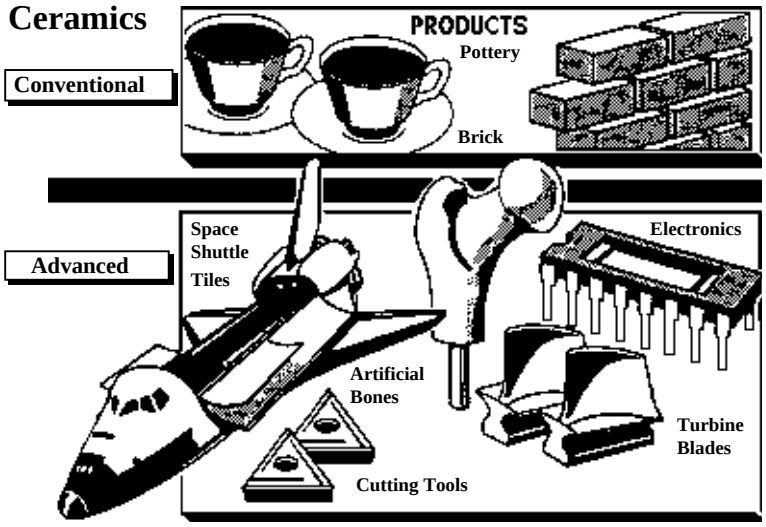

Figure 1: Ceramics

Ceramics are materials that are composed of inorganic substances. Ceramics is a refractory, inorganic, and nonmetallic material. Traditional ceramics include clay products, silicate glass and **cement**; while advanced ceramics consist of carbides (SiC), pure oxides (Al_2O_3), nitrides (Si_3N_4), non-silicate glasses and many others.

Ceramic Compound	**Melting Point ˚C**
Magnesium Oxide	2798˚
Aluminum Oxide	2050˚
Silicon Dioxide	1715˚
Silicon Nitride	1900˚
Silicon Carbide	2500˚

Product Area	**Product**
Aerospace	space shuttle tiles, thermal barriers, high temperature glass windows, fuel cells
Consumer Uses	glassware, windows, pottery,magnets, dinnerware, ceramic tiles, lenses, home electronics, microwave transducers
Automotive	catalytic converters, ceramic filters, airbag sensors, ceramic rotors, valves, spark plugs, pressure sensors, thermistors, vibration sensors, oxygen sensors, safety glass windshields, piston rings
Medical (Bioceramics)	orthopedic joint replacement, prosthesis, dental restoration, bone implants
Military	structural components for ground, air and naval vehicles, missiles, sensors
Computers	insulators, resistors, superconductors, capacitors, ferroelectric components, microelectronic packaging
Other Industries	bricks, cement, membranes and filters, lab equipment
Communications	fiber optic/**laser** communications, TV and radio components, microphones

One of the most interesting high-temperature applications of ceramic materials is their use on the space shuttle. Almost the entire exterior of the shuttle is covered with ceramic tiles made from high purity amorphous silica fibers. Those exposed to the highest temperatures have an added layer of high-emittance glass. These tiles can tolerate temperatures up to 1480˚ C for a limited amount of time. Some of the high temperatures experienced by the shuttle during entry and ascent are shown in Figure 2.

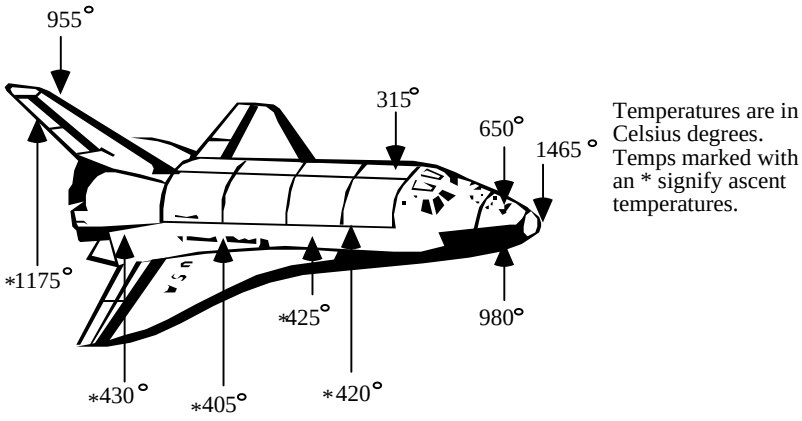

Figure 2: Space shuttle's ascent and descent temperatures