

## ADVANCES IN CERAMICS

One of the most prominent examples of the rapid and accelerating technological development is the electronics industry, more specifically the simple transistor. The push has been along miniaturisation and packing the maximum amount of performance into the smallest space. Recently noted, an e-mail quote stated that; “If the Automotive industry had advanced at the same pace as the Computer industry, we would be driving cars, which gave a thousand kilometres to the litre and cost =N=3000.00”. The concept of the simple transistor stands as one of the most significant electronic engineering achievements of the 20th century.

Ceramics, brittle by nature, having a more complex chemistry and requiring advanced processing technology and equipment to produce, perform best when combined with other materials, such as metals and polymers which can be used as support structures. This combination enables large shapes to be made, the Space Shuttle is a typical example of the application of advanced materials and an excellent example of the capability of advanced materials. With the development of phase transformation toughening of PSZ (partially stabilised zirconia) ceramic, the way ceramic systems were viewed changed. Therefore, the techniques of Phase transformations, alloying, quenching and tempering, were applied to a range of ceramic systems. Significant improvements to the fracture toughness, ductility and impact resistance of ceramics were realised and thus the gap in physical properties between ceramics and metals began to close.

The new and emerging family of ceramics are referred to as advanced, new or fine, and utilise highly refined materials and new forming techniques. These ceramics, when used as an engineering material, possess several properties which can be viewed as superior to metal-based systems. Their properties, which include high resistance to abrasion, excellent hot strength, chemical inertness, high machining speeds (as tools) and dimensional stability, place this new group of ceramics in a most attractive position, not only in the area of performance but also cost effectiveness. They are classified as earlier discussed but a new sub-group, Composites can be added. They include Particulate reinforced, combinations of oxides and non-oxides.

Ceramic based composites can be composed of a combination of: oxide ceramics – non-oxide ceramics (granular, platy, whiskers, etc.), oxide - oxide ceramics, non-oxide – non-oxide ceramics, ceramics - polymers, etc. an almost infinite number of combinations are possible. The objective here, is to improve either the toughness or hardness in order for the material to be more suited to a particular application. Compositions can also include metals in particulate or matrix form. Each ceramic type has its own special requirement in regard to firing rate, environmental condition and temperature. If these conditions are not met then the quality of the final product and even the formation of the final compounds and densities will not be achieved.

## RECYCLING CERAMICS

Ceramics can be crushed and recycled into a range of useful products, diverting waste from landfill and decreasing emissions and toxic outputs used in the production process. Redirecting this waste can also help avoid costly landfill charges. By recycling or reusing these ceramics, large amounts of waste is diverted from landfill as well as helping reduce the demand for natural resource. Ceramics is emissions intensive and involves a number of toxic substances used as glazes, but recycling or reusing ceramic products can decrease these outputs. Redirecting waste also helps avoid increasingly costly landfill charges.

When recycled ceramics can be made into useful products such as drainage materials, rock base for driveways and paths or as composite material for aggregates.

Some companies that recycle are making tiles from the toilets, others add 20% of old cups into the new ones. Anyway the process requires lots of energy for crushing the shards into smaller particles till they get back almost to the state of raw material. But even then its qualities are different and it can't be used alone on its own, only as an addition to the regular clay.