

# **CERAMIC ADHESIVE CONSIDERATIONS**

## **THERMAL EXPANSION**

Hottec offers a wide range of Ceramic Adhesives. This results from the wide range of materials and conditions that the materials will be subject too. The major consideration will be the extreme temperature range as well as the brittle nature of ceramics. There are tremendous forces generated when a material expands over a large temperature range. Conventional adhesives need only be concerned with temperature fluctuation in the normal environmental range of 150 to 200 ° F. additionally most are organics with high flexural strength. Ceramics must endure fluctuations of up to 4000 °F so that great changes in dimensions take place. The solution is to have materials with similar coefficients of thermal expansion. This will include both the 2 materials being joined but also the expansion of the adhesive material itself. Please review the thermal expansion of your materials on the <<link Thermal Expansion Tables>>, which has common materials as well as our adhesives. These materials will change dimensions together thus minimizing the stress. If it is not possible to use materials of very close thermal expansion properties it would be an advantage to pick an adhesive with expansions midway between the 2 or perhaps change or introduce a third component with middle properties so that the stress is spread over more than one joint.

## **ENVIRONMENTAL FACTORS**

The other main selection criteria are the environment that the joint will be placed in and the changes, which may have to endure. There are some ceramic adhesives that are stronger at a continuous 2000°F than at room temperature. Atmospheric considerations such as moisture, acid, or alkaline, vacuum or corrosive gasses can all attack the adhesive joint. Look for the adhesive that tolerates the conditions that will exist for the parts. Thermal cycling to room temperature and back up such as in firing operations will also expose the joint to air and potential moisture absorbance. This atmospheric moisture will have to be driven off prior to exposure to high heat. The data screens will have pertinent information about what this material can tolerate.

## **CURING**

Lastly to select what adhesive to use will be its requirement for curing. Most of these materials have to 2 types of moisture in them. There is the free water that is what makes them a liquid and also waters of solution and crystallization. Many ceramics actually have water as part of their crystal make-ups. These waters usually have to be driven off before the joint is taken to higher temperatures. Therefore most ceramic materials have a 2 stage curing procedure where by the free water is eliminated at a below water boiling point of 212°F by simple air-drying in an oven. Next there is a higher heat cure where the molecular crystal water is driven off at a higher temperature. This will cure most of the materials and make the joint moisture resistant, however if the joint has been soaked in water some gentle drying may be required so that steam generated will not force the joint apart.