

# NC Products

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## No Cement Product Line

Reno Refractories produces a complete line of castables based on the sol-gel principle. Due to unique physical characteristics of sol-gel materials, this process has often been used in the manufacture of high performance ceramics. The bonding system which utilizes colloidal silica as a source of nano-scale spherical particles, has many technical advantages over other bonding techniques. Castables based on this technology attain properties that are not achievable with cement and conventional particle packing technology.

### Key Features

#### Hot Strength

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This new generation of castables incorporates a mullite forming binder system. Reno's No-Cement Castables achieve a 100% to 300% increase in hot modulus of rupture @ 2500 F when compared to low cement castables of equal density and mineralogy. Greater hot strengths provide less erosion by dust laden air streams at high temperatures. Reno's NC castables can be confidently used to much higher temperatures for a given alumina content.

#### Alkali Resistance

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The No-Cement bond does not contain calcium compounds (calcium silicate, calcium aluminate) which expand and cause cracking after reacting with sodium or potassium vapors. The gel bond based upon amorphous silica, is much more resistant to reaction with alkali vapors in the 1100 - 2000 F temperature range.

#### Thermal Shock

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Reno's NC castables retain more than 80% of their original strength when tested using the ASTM C-704 shock procedure. These values are usually 50 to 100% greater than competitive cement bonded materials. The improvement is due to the non crystalline nature of the gel bond. It is more "flexible" and resists damage due to expansion/contraction.

#### Pore Size Reduction

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Common to all of Reno's No-Cement Castables, which incorporate nano particles into the bond, the pore size openings are considerably smaller. Typically, the majority of pores in the bond phase are one to two microns in size versus 10-30 microns for low cement castables of equal mineralogy. With smaller pores, the ability of slag or other liquids to enter the structure and react with the refractory is reduced. This essentially makes the material "non-wetting" to most metals and less reactive to vapors.

#### Dry Out

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This new generation of castables do not require the long curing times necessary for cement bonded castables. The sol-gel bond operates by different processes from cement. Hence the heatup for these materials can begin as soon as the installation is complete. A savings of four to twenty four hours in down time due to curing can be realized.

Additionally, during the setting process cement bonded castables react with water and incorporate it into calcium aluminate-hydrate crystal structures. It is difficult to decompose these crystalline bonds in order to release the water. The vapors must then diffuse through the structure of the castable and out to the atmosphere. Temperatures above 550 F must be attained to decompose the cement bond and release this water. Pressure can buildup and explosive spalling occur unless the heating rate is very slow.

With sol-gel castables, this chemical water is not formed. The moisture is easily released and dissipated through the lining. Time savings of twenty to thirty percent can be achieved in the bake out process due to more rapid moisture released. The NC materials have greater permeability than comparable cement bonded castables.