

# Fabrication of Functional Non-firing Ceramics through Mechano-chemical Treatment

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## ◆ Abstract

In order to reduce the cost and energy for post-forming processes, a novel method named non-firing ceramics fabrication process was proposed, which means treat the surface of raw powder by mechanically activation via planetary ball mill in terms of leading to the appearance of strong siloxane bonding and other active sites. Continuously, dispersed activated ceramic powder in some alkaline solvent to form precipitates between the grains through re-precipitation mechanisms to prepare ceramics solidified body without any calcination (Fig.1)<sup>[1]</sup>. To prepare functional ceramics, carbon nanotubes (CNTs) demonstrate exceptional properties and their unique tubular structures are believed to be the ultimate reinforcement in ceramic composites. The mechanical and physical properties of ceramics could be improved by incorporating CNTs in the matrix.

## ◆ Experimental

A planetary ball mill in zirconia balls and vials was performed to active surface of silica powder under revolution rate of 200 r/m persist 15 minutes. Pre-treat silica powder was mix with CNTs. Silica/CNTs compounded powder was then transfer to tumbler ball mill for 10h in order to ensure well mixture of materials. 1M KOH dropped into powder to prepare ceramic slurry. The slurry was mixed by electric mixer and kept 5h at 80°C for solidify. Morphology of ceramic body cross-section view was observed by SEM and electrical conductivity was measured via four-probe Van der Pauw method.

## ◆ Results and discussion

A few CNTs are apparent on the fracture surface of CNTs/SiO<sub>2</sub> composite can be seen from Fig.2. Parts of matrix grains are obtained because minimum amount of the active powder surface necessary for solidification is dissolved and precipitated. CNTs network is visible emerging among solid body to provide the possibility of electro-conductivity path. 56.8Ω·m of sample's electrical resistivity was obtained, which substantial improves when compare with common ceramic materials.

## ◆ Reference

[1] Takashi Shirai et al., J.Jpn. Soc. Powder Powder Metallurgy, 59(2012)417-521.

### Key technology of Non-firing ceramics process

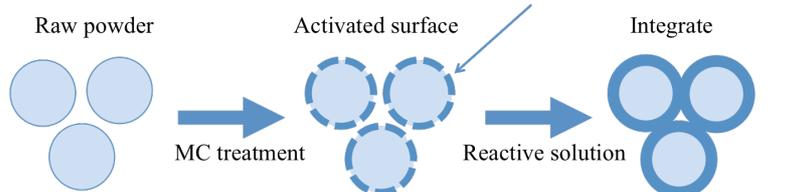


Fig.1. Illustration of MC treatment process.

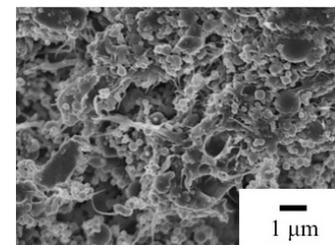


Fig.2. SEM image of CNTs/ceramic microstructure.