

Pornpimol Kuntajinda 2011: Residual Strain Adjustment to Enhance Machinable Glass-Ceramics Forming as a Restorative Dental Material using CAD/CAM System. Master of Engineering (Materials Engineering), Major Field: Materials Engineering, Department of Materials Engineering. Thesis Advisor: Assistant Professor Duangrudee Chaysuwan, Ph.D. 120 pages.

The purpose of this research was to reduce residual strain with in the glass rod of glass ceramics of the $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-MgO-MgF}_2\text{-SrCO}_3\text{-CaCO}_3\text{-CaF}_2\text{-P}_2\text{O}_5$ glass system in which contained fluorapatite of 2.5, 3.5 and 4.0 mole%, respectively, by annealing process at $T_g+20\text{ }^\circ\text{C}$ and $T_g-50\text{ }^\circ\text{C}$. The effect of residual strain on mechanical properties, e.g., biaxial flexural strength and Vickers hardness was focused. Glass rods were first prepared and reduced residual strain by annealing process for 2 h at $T_g+20\text{ }^\circ\text{C}$ and $T_g-50\text{ }^\circ\text{C}$. A strain viewer was used to observe the residual strain in the glass rod before and after annealing. Thereafter, the glass rod was heat-treated with the suitable heat treatment to transform to a glass ceramic rod. The glass ceramics were analyzed with the standard for restorative dental materials according to ISO 6872:2008(E). Each glass ceramic was cut, ground and polished as a block and was formed by CNC controlled with CAD/CAM system to apply for dental materials.

As a result, the annealing process at $T_g-50\text{ }^\circ\text{C}$ was more effective than that at $T_g+20\text{ }^\circ\text{C}$ to reduce residual strain. The mechanical properties, e.g., strength, hardness and fracture toughness were suitable according to ISO 6872:2008(E) and it was classified as Type 2 Class 2 substructure (core) dental ceramics. After forming by CNC controlled with CAD/CAM, the glass ceramic specimens presented without microcracks and accurately desired shapes. It was found that in the research GCF 3.5 was the most suitable to use as a dental restorative materials.

Student's signature

Thesis Advisor's signature