

Effects of binders and internal lubricant compositions on mechanical properties of dry pressed sintered alumina

ABSTRACT

This project investigates the effect of polymeric binders and internal lubricant on mechanical properties and microstructure of sintered alumina. Three different formulations of alumina-binders were used which contained 3 wt% of Polyethylene Glycol (PEG) and various amount of polyvinyl alcohol (PVA) from 1 wt% to 3 wt%. About 3 wt% of stearic acid was used as an internal lubricant. Spray dry is the method that used to coat alumina powder with binders. Thermogravimetry analysis (TGA) was applied to determine the decomposition temperature of binders in the alumina-binder samples. Diametral compressive test was conducted to determine the tensile strength meanwhile the microstructure of fracture surface of sintered alumina was characterized by means of Scanning Electron Microscope (SEM). The TGA analysis results show the suitable temperature for debinding process is 450oC. It is shown that the shrinkage of sample is increased with increasing the binder content and it has achieved to the maximum of 45 % after the sample was sintered at temperature of 1600oC and 1700oC. Alumina sample which have formulation of 2 wt% PVA and 3 wt% PEG binders and sintered at temperature of 1400°C shows the highest tensile strength (68.4 MPa). The presence of 3 wt% stearic acid has given detrimental effect on the mechanical properties of the sintered alumina.

Keyword: Binder; Alumina; Internal lubricant; Polyethylene glycol (PEG); Polyvinyl alcohol (PVA)