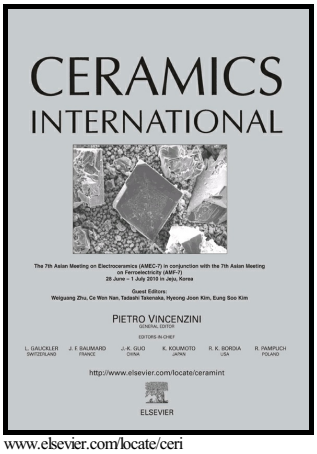

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Parametric optimization of dry sliding wear and friction of germanium doped lead calcium titanate borosilicate glass ceramic

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Abstract

In this study, specific wear rate (SWR) and coefficient of friction (COF) of the synthesized samples in $55[(Pb_xCa_{1-x})O.TiO_2]$-$44[2SiO_2.B_2O_3]$-1Ge with ($0 \leq x \leq 0.7$ mole%) system of glass ceramics was optimized using Taguchi method. The ASTM standards were used for preparing the samples for friction and wear tests on a pin-on-disc tribometer. The glass ceramic samples were used as pin materials that slid against a disc made up of EN32 steel. For assessing the tribological properties of the glass ceramics, three control factors, viz. material-compositions with varying fraction of x (x=0.0, 0.1, 0.3, 0.5 and 0.7 mole %), sliding speeds (2.61, 3.14, 3.66, 4.18 and 4.71 m/s) and loads (10, 15, 20, 25 and 30 N) were considered in an L_{25} orthogonal array design. The optimum input parameters for the minimum SWR and COF were selected based on signal to noise ratios and main effect plots. Analysis of variance (ANOVA) revealed that the sliding speed and lead oxide content of the material are the most contributing factors on SWR and COF, respectively. The optimization for minimizing the SWR and COF was carried out and confirmed. The surface morphologies of the tested glass ceramic sample were studied using scanning electron microscope (SEM) and the elemental analysis of the samples was done using energy dispersive analysis of X-rays (EDAX). The Vickers hardness at the free surface of the glass ceramic samples