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Effect of normal load and sliding speed on dry sliding wear and friction properties of germanium doped borosilicate glass ceramic

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Introduction: A polycrystalline material termed as glass ceramic largely possesses superior abrasive resistance, thermal stability and chemical resistance that make them suitable for different industrial applications in the fields of metallurgical, mechanical, chemical and electrical engineering. The properties and functions of glass ceramics are largely affected by the intricate interactions of structural, chemical composition of initial glass and process variables. Hence, in order to obtain the glass ceramics with desired thermo-physical properties, the optimization of compositions, nucleating agents and heat treatments is essential. Herman, et al. precipitated gahnite phase in CaO-MgO-ZnO-Al₂O₃-B₂O₃-SiO₂ system of glass ceramics. They observed a relative increase in fracture toughness and wear resistance compared to the two phase materials. Xiao, et al. studied the mechanical and tribological properties in CaO-MgO-Al₂O₃-SiO₂ glass ceramic system. They found that the Specific Wear Rate (SWR) of the material lies in the range of 10⁻³ to 10⁻⁶ mm³/Nm. The samples were prepared according to ASTM standard for tribological experiments that are to be performed on a pin-on-disc tribometer. The wear and friction studies of the samples were carried out at three different applied loads (10 N, 20 N and 30 N) and sliding speeds (500, 700 and 900 rpm) under dry condition.

Conclusion: The tribological investigation on glass ceramic samples in the system 55[(Pb_xCa_{1-x}) O. TiO₂]-44[2SiO₂. B₂O₃]-1Ge with (0 ≤ x ≤ 0.7 mol%) reveals that they have good wear resistant properties. The SWR of the samples vary in the range of 3×10⁻⁴ mm³/m to 5.5×10⁻⁴ mm³/Nm and the COF vary in the range of 0.09 to 0.42. Hence, they can be used in Microelectromechanical Systems (MEMS) e.g. in making accelerometers and gyroscopes.

Biography

S. S. Gautam is presently working as an Associate Professor in the Department of Mechanical Engineering in North Eastern Regional Institute of Science and Technology, Arunachal Pradesh, India. He received his M.Tech and PhD degree from IIT Banaras Hindu University (Formerly IT BHU). His research areas are tribology of bearings, seals and materials. Dr. Gautam has supervised/ supervising 3 PhD research scholars and several M.Tech scholars. He has published around 25 journal papers and 10 conference papers. He has authored 2 book proceedings.

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