Investigation of Low Temperature Plasma Technologies using Glass Samples

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Abstract

This study focuses on the utilization of low temperature plasma technologies in conjunction with glass dielectric samples. It is a joint effort on behalf of Coe College's and Seton Hall University's physics departments glasses. Sodium borate ($xNa_2O\cdot(1-x)B_2O_3$) and sodium silicate ($xNa_2O\cdot(1-x)SiO_2$) glasses, were synthesized at Coe College in Cedar Rapids, Iowa. The project investigates the role of glass at Seton Hall as a dielectric component in Dielectric Barrier Discharges (DBD) plasma generation. DBD plasmas are created between metal plates covered by a dielectric layer, which suppresses current and promotes diffusion losses to maintain a low gas temperature. However, there is a lack of research on the glass component's influence on plasma formation. To address this, glasses with varying compositions $xNa_2O\cdot(1-x)B_2O_3$ or $xNa_2O\cdot(1-x)SiO_2$, $0 \leq x \leq 0.4$ were prepared by weighing out appropriate amounts of sodium carbonate, silica, and boric acid powders in a platinum crucible and heating them at specific temperatures of 1100 °C – 1300 °C. They were then sent to Seton Hall to gain insights into the dielectric properties of these glass samples and develop new materials for enhanced control of plasma formation. Applications being studied include O_3, H_2 and OH_2 formations.

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