Thermal poling is a technique which consists in the application of a strong DC electric field to a heated glass substrate. Following the treatment, a static electric field is frozen inside the glass matrix, effectively breaking its centrosymmetry. Presence of the electric field allows for second order nonlinear optical properties usually forbidden in centrosymmetric medium such as glasses. In addition to nonlinear optical properties, the induced electric field has been associated with structural/compositional modifications as well as surface property changes. Our objective was to use this technique to tailor surface reactivity and optical properties in oxide (borosilicate and niobium borophosphate) and chalcogenide glasses. After poling, structural modifications were investigated using Raman and infrared spectroscopy. Strength and localization of the electric field were characterized by Second Harmonic Generation (SHG) techniques: quantitative Maker fringes analysis and µSHG imaging. The treatment successfully allowed to locally enhanced the surface reactivity of a borosilicate glass. In niobium borophosphate and chalcogenide glasses, the treatment allowed to control optical properties both linearly and nonlinearly at the micrometric scale. These results show that thermal poling could be used to create functional devices for applications in integrated photonics.

Major: Materials Science and Engineering

Educational Career:
Bachelor's of Chemistry, BS, 2010, Ecole Nationale Superieur
Master's of Materials Science, MS, 2013, Ecole Nationale Superieur

Committee in Charge:
Kathleen Richardson, Chair, Materials Science & Engineering
Sudipta Seal, Materials Science & Engineering
Romain Gaume, Materials Science & Engineering
Marc Dussauze, University of Bordeaux
Stephen Kuebler, Chemistry

Approved for distribution by Kathleen Richardson, Committee Chair, on October 12, 2016.

The public is welcome to attend.