Advancing the Application of Planar Chalcogenides

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Interest in low-loss planar glass films has been intense due to potential applications in integrated optics. In particular the development of low loss planar waveguides has been the focus of much research and a wide variety of film deposition and waveguide formation methods have been developed in particular for silica on silicon. However, the need for compact planar devices incorporating active components, such as modulators or switches, requires the application of glasses with high non-linearity. We report here on recent progress in the deposition, characterization and application of glasses in the chalcogenide family including those based on gallium and lanthanum sulphides and germanium sulphide.

We have deposited films ranging in thickness from ~5μm to 500μm using inverted hot-dip spin coating have more recently demonstrated the deposition of thin films using RF sputtering. These films have now been deposited onto a wide variety of substrates including silicon, silica, gold and crystals showing excellent adhesion in each case. We are also currently exploring the deposition of chalcogenide glasses using thermal evaporation techniques, which provides further enhanced capability. Finally, we have developed a chemical vapour deposition (CVD) technique for the deposition of glass films directly from gaseous precursors. These films have been used as the basis from which planar optical waveguides are formed using direct laser witting or patterning techniques and for a variety of characterization experiments, including loss, purity, resisivity and photosensitivity.

In parallel with these activities, efforts to ensure high purity have successfully reduced transition metal impurities and OH to levels below 1 ppm. These processes have opened up the potential for chalcogenide films and glasses to be developed with purities similar to those achieve in silica.

The talk concludes with an overview of the applications which are currently motivating this work.