# List of Figures

1.1 The Lycurgus Cup. ......................................................... 3  
1.2 Surface Plasmons ......................................................... 8  
1.3 The Metal-Insulator-Metal Waveguide ............................... 9  
1.4 Metal-Insulator-Metal Generalized Schematic ..................... 10  

2.1 32 Crystal System Symmetries ....................................... 14  
2.2 $\text{ABO}_3$ Perovskite Unit Cell .................................. 15  
2.3 Landau Spontaneous Polarization .................................. 18  
2.4 Piezoresponse Force Microscopy .................................... 19  
2.5 Contact Angle Measurements ....................................... 21  
2.6 The Layer Transfer Process ........................................ 22  

3.1 Contact Angle Measurements ........................................ 26  
3.2 Equilibrium concentration of available species in implanted BaTiO$_3$ as a function of temperature and pressure ......................................................... 28  
3.3 Equilibrium concentrations in the Ba-Ti-O-H system during cavity formation .......... 29  
3.4 Cracking and blistering during layer transfer ...................... 31  
3.5 Forward recoil electron spectroscopy of implanted BaTiO$_3$ .................. 32  
3.6 Raman spectroscopy of BaTiO$_3$ before, during, and after layer transfer and post-bond annealing ......................................................... 33  
3.7 TEM of layer transferred BaTiO$_3$ .................................. 34  
3.8 AFM and PFM of bulk and layer transferred BaTiO$_3$ .............. 35  
3.9 AFM and PFM of BaTiO$_3$ films using PLD and layer transfer ........ 36  
3.10 Hysteresis curves of PLD and layer transferred BaTiO$_3$ .......... 37  

4.1 Layer transfer geometry ............................................. 41
4.2 Geometry of a perturbed crack propagating in a film
4.3 Debonding with and without buckling
4.4 Energy release rate of an interfacial crack
4.5 Crack evolution diagrams thick and thin transferred layers
4.6 Transverse cracks during layer transfer under no applied stress
4.7 Telephone-cord-like cracks in compressively stressed LiNbO$_3$
4.8 A buckled region of LiNbO$_3$
4.9 Crack evolution diagram for the experimentally tested LiNbO$_3$

5.1 TEM sample extraction in the FIB
5.2 TEM of Lithium Niobate Sample
5.3 Formation of the Silver Bond
5.4 Silver Grain Growth
5.5 Silver XRD before and after annealing

6.1 Lithium Niobate MIM Device Schematic
6.2 Lithium niobate membrane fabrication
6.3 Lithium niobate membranes before and after FIB
6.4 1964 CIE RGB Color Matching Functions
6.5 1964 CIE RGB Color Matching Functions
6.6 Silicon Nitride MIM Device Dispersion
6.7 Lithium Niobate Output Colors with Varying Slit Spacing
6.8 Power transmission through LiNbO$_3$ waveguides
6.9 Lithium Niobate MIM Dispersion Diagram
6.10 Mode Profiles within MIM Waveguides
6.11 Trapezoidal Slit Transmission with varying Dimensions
6.12 Trapezoid/Rectangle Hybrid Slit Transmission with varying Dimensions
6.13 Three-dimensional Implementation of MIM Color Filters

7.1 plasmostor Membrane Fabrication
7.2 XRD and Raman measurements of Silicon Membrane Strain
7.3 plasmostor Device Schematic
7.4 plasmostor Membrane Overview
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>plasMOStor Dispersion</td>
<td>95</td>
</tr>
<tr>
<td>7.6</td>
<td>plasMOStor Dispersion</td>
<td>96</td>
</tr>
<tr>
<td>7.7</td>
<td>plasMOStor FDTD Simulations at $\lambda = 1550$ nm</td>
<td>97</td>
</tr>
<tr>
<td>7.8</td>
<td>plasMOStor FDTD Simulations at $\lambda = 685$ nm</td>
<td>98</td>
</tr>
<tr>
<td>7.9</td>
<td>Capacitance-voltage and switching behavior of individual devices.</td>
<td>99</td>
</tr>
<tr>
<td>7.10</td>
<td>plasMOStor Switching</td>
<td>100</td>
</tr>
<tr>
<td>7.11</td>
<td>plasMOStor Circuit Analysis</td>
<td>104</td>
</tr>
<tr>
<td>8.1</td>
<td>Plasma Frequency as a Function of Carrier Density</td>
<td>107</td>
</tr>
<tr>
<td>8.2</td>
<td>MOS Structure Studied for InTiO$_3$ Ellipsometry</td>
<td>108</td>
</tr>
<tr>
<td>8.3</td>
<td>Ellipsometry of InTiO$_3$ Under Applied Field</td>
<td>109</td>
</tr>
<tr>
<td>8.4</td>
<td>Calculated Broadband Complex Index of InTiO$_3$</td>
<td>110</td>
</tr>
<tr>
<td>8.5</td>
<td>Accumulation Layer Complex Index in InTiO$_3$</td>
<td>111</td>
</tr>
<tr>
<td>8.6</td>
<td>Optical Modes in a Au/InTiO$_3$/SiO$_2$/Au Waveguide</td>
<td>112</td>
</tr>
<tr>
<td>9.1</td>
<td>Summary of Parameters Studied to Affect Color Filter Output Spectrum</td>
<td>115</td>
</tr>
<tr>
<td>9.2</td>
<td>Summary of Parameters Studied to Affect plasMOStor Output Spectrum</td>
<td>116</td>
</tr>
<tr>
<td>A.1</td>
<td>Coordinates for MIM Dispersion Calculations</td>
<td>119</td>
</tr>
<tr>
<td>B.1</td>
<td>Three-Dimensional Piezoresponse Plot for Barium Titanate</td>
<td>131</td>
</tr>
<tr>
<td>C.1</td>
<td>Schematic of Spectroscopic Ellipsometry</td>
<td>133</td>
</tr>
<tr>
<td>C.2</td>
<td>Ellipsometry of InTiO$_3$</td>
<td>134</td>
</tr>
</tbody>
</table>