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Multifunctional Oxides: Growth and Integration

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Recently, the formation of new classes of integrated structures based complex oxides has been pursued. The application of low temperature growth techniques have allowed the development of important oxides, such as lithium niobate, in forms not previously achieved through the processing of traditional bulk materials. The application of epitaxial processes to these systems can generate new function and levels of performance in optical devices. More intriguing applications are being developed through the integration of these materials directly with semiconductors. The deposition and thermal processing of complex oxide materials on semiconductor surfaces are complicated by many issues which impact the long term stability of these interfaces. These oxides are often characterized by a very large phase stability region leading to a broad range of stiochiometry, particularly in comparison to conventional semiconducting materials, a variety of types and concentrations of defects, and the possibility of ionic diffusion and conductivity. The general features of simple reaction systems will be reviewed and applied to the complex oxides. The development of other approaches based on recent advances and applications in materials integration techniques, such as wafer bonding, bypass many of these issues and can lead to a more general technology for the formation of new multifunctional devices.