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# Advanced Light Emitting Device Structures for Optoelectronic Applications

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Several factors are driving the recent development of light emitting devices (LED's). The most important ones are brightness, available efficiency, architecture form flexibility, rugged construction and low applied voltages. These are contributing to growth in markets such as traffic lights, automotive brake signals and instrument displays, video displays, traffic signals, decorative signs and the many uses of the new white LED-based products. A new developments are directed to various materials used for high brightness HB-LED's based on AlGaAs (red), AlInGaP (yellow-green to red) and InGaN (blue, green and white) devices. The development of LED's depends on epitaxial growth advances, mainly molecular beam epitaxy (MBE) and metalorganic vapor phase epitaxy (MOVPE). As a technology improved, the performace of visible LED's increased at the rate 10x per decade from less than 0.1 lm/W to the best red and orange LED's now providing about 100 lm/W. The main engineering challenge is now the extraction or the ability to get all the light out of the chip to where it is needed. This has led to novel changes in the shape of the LED chip and to the replacement of GaAs with transparent GaP substrate throught wafer bonding after the LED has been produced. Most of the focus for nitride devices (InGaN) is to develop improved or new substrate materials to replace sapphire and enable the growth of lower defect density materials. Organic LED's (OLED's) have been undergone dramatic improvements in performace in the last five years. Two main technologies for OLED's have emerged in the last decade, either based on conjaguated polymers, or sublimed films of small molecules. Recent improvements have taken OLED's to luminous efficiency greater than 20 lm/W. However, in contrast to conventional LED's, OLED's share many of the properties associated with other organic substances and polymers. They allow more design flexibility than inorganic LED's and thus lead to the high-resolution displays.

In the talk recent developments in technology, structures and applications of LED<sup>s</sup> and OLED's will be presented.