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Advances in UV-LED devices and high-density flip-chip packaging technology

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In recent years, the application fields of UV-LED based on III-nitride materials keep expanding and these create a huge potential market. The AlGaIn-based UV-LED devices (265nm-400nm) show a great prospecting in the structural analysis of biological and chemical agents, biological agents, biological and chemical weapons detection and warning, water and air purification, disinfection and sterilization, printing, packaging, advertising, building materials, decoration, electronics, household appliances, optical fiber, automobiles and other military and civilian fields. At present, the UV-LED attracts more and more attention of the major companies (Philips, LG, etc.) and research institutions (University of South Carolina, RIKEN, University of Texas-Austin, University of California-Santa Barbara, etc.) all over the world. However, different from the blue LED, many urgent practical problems restrict the performances of UV-LED currently, such as the huge device heat, low light extraction efficiency and poor reliability, resulting in poor light efficiency, short life. Besides the improvement of chip fabrication technique, the packaging technology also has an important impact on the characteristics of UV-LED devices.

In this report, we studied the growth parameters and doping process of high Al-content AlGaIn films by metal-organic chemical vapor deposition (MOCVD). The structures of multi quantum wells were designed and deposited on high-quality AlGaIn layers. Then we fabricated the UV-LED flip-chip structures, and carried out the research on UV-LED device packaging design and flip-chip packaging technology at the low thermal resistance. This study laid a foundation for high-power, high-density UV-LED devices in the practical applications.

References:

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