異種基板の張り合わせと界面熱抵抗
Bonding of different substrates and the thermal resistance generated at the interface

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概要

Materials integration has become more important to realize the full potential of different materials and to create composite systems with properties not obtainable by monolithic materials. One of the applications is the integration of wide bandgap high power semiconductor devices (e.g. GaN HEMT) onto a substrate with a high-thermal-conductivity (e.g. SiC, diamond, etc.). Hetero-epitaxial growth is widely employed to realize this material integration but is limited by lattice mismatch, defects and interfacial materials that give rise to additional thermal resistance. Bonding at a low temperature is a promising alternative method to realize the material integration without the limitation of the growth method, while enjoying the benefits of the material's high quality. In this work, a heterogenous GaN-SiC integration via a room temperature wafer bonding method has been realized and the thermal boundary resistance (TBR) of the bonded interface has been measured by TDTR. The GaN-SiC bonding can achieve a bonding energy of ~1.6 J/m^2 and the measured TBR is slightly larger than that of the GaN grown on SiC with an AlN layer. After annealing at 1273 K for 10 mins, the TBR decreases to about 4.3 m^{2}K/GW, one of the lowest reported TBR experimental values reported for GaN-SiC.

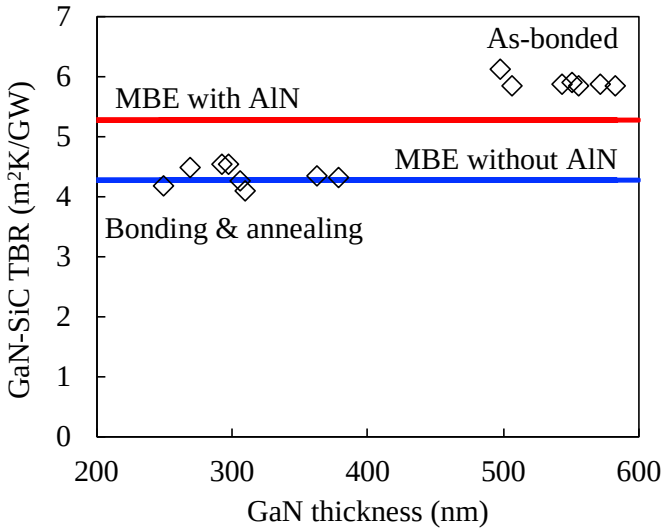

Figure 1. GaN-SiC TBR for annealed and as-bonded samples.