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Integration of heterogeneous materials is crucial for many nanophotonic devices. The integration is often achieved by bonding using polymer adhesives or metals. A much better and cleaner option is direct wafer bonding, but the high annealing temperatures required make it a much less attractive option. Direct wafer bonding relies on a high density of hydroxyl groups on the surfaces, which may be difficult to achieve depending on the materials. Thus, it is a challenge to design a universal wafer bonding process. However, using an intermediate layer between the bonding surfaces reduces the dependence on the bonding materials, and thus, the bonding mechanism essentially remains the same. The authors present a systematic study on the use of Al2O3 as an intermediate layer for bonding of heterogeneous materials. The ability to achieve high hydroxyl group density and well-controlled films makes atomic layer deposited Al2O3 an excellent choice for the intermediate layer. The authors have optimized the bonding process to achieve a high interface energy of 1.7 J/m2 for a low temperature annealing of 300 °C. The authors also demonstrate wafer bonding of InP to SiO2 on Si and GaAs to sapphire using the Al2O3 interlayer. Published by the AVS.