Reviews on Advanced Materials and Technologies, 2025, vol. 7, no. 1, pp. 18–23
DOI: 10.17586/2687-0568-2025-7-1-18-23

Formation of Interfaces in Direct Bonded Heteropolytype SiC Structures Mediated with Liquid and Vapor Phase of Silicon

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Abstract. It is shown that heteropolytype silicon carbide structures can be obtained by direct bonding of wafers of different SiC polytypes by high-temperature treatment in vacuum. Heteroepitaxial 3*C*-SiC layers grown by the CVD method on a Si substrate were successfully transferred to 6*H*-SiC wafers. It was found that nanometer-thick bonding layers formed at the 3*C*-SiC/6*H*-SiC interface were the layers of recrystallized melt originating in a meltdown of the Si substrate of starting 3*C*-SiC/Si specimens. This example of transferring is a promising way for producing 3*C*-SiC/6*H*-SiC template for growing homoepitaxial 3*C*-SiC films of device quality. Feasibility of direct bonding of SiC single-crystal wafers in a silicon vapor environment also demonstrated. The motivation for these studies is development of prospective power devices on the base of 4*H*-SiC/6*H*-SiC heteropolytype junctions. It is shown that a necessary condition for bonding is a gap capable of providing vapor transport at the interface between the wafers. The gap was obtained by preliminary self-structuring of the surface of bonded SiC wafers with their annealing in vacuum.

Acknowledgements. This study supported by the Russian Science Foundation, project no. 24-22-00232. TEM characterizations were performed using equipment of the Federal Joint Research Center “Material science and characterization in advanced technology” supported by the Ministry of Education and Science of the Russian Federation (id RFMEFI62117X0018).

Citation: Rev. Adv. Mater. Technol., 2025, vol. 7, no. 1, pp. 18–23

View online: https://doi.org/10.17586/2687-0568-2025-7-1-18-23

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