Improved Uniformity and Breakdown Strength of Schottky Barrier Diodes Fabricated on Diamond Heteroepitaxial Substrates

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Pseudo-vertical diamond Schottky barrier diodes (SBDs) were fabricated on heteroepitaxial substrates. In this study, a metal-assisted termination (MAT) technique to suppress killer defects was utilized [1]. SBDs properties on heteroepitaxial substrates after utilizing MAT technique were investigated. Fig. 1(a) shows superimposed *I-V* characteristics of 20 SBDs. All diodes exhibited good properties with a high rectifying ratio surpassing 8 orders at voltage between ±8 V. Undetectable leakage current were observed among examined diodes, indicating high in-plane uniformity. Fig. 1(b) presents reverse voltage characteristics. The diode showed clear breakdown behavior with sudden increase in current at 375 V. Breakdown field strength (E_{max}) was estimated to be 1.7 MV/cm, which is the highest value reported for SBDs on heteroepitaxial substrates [2]. The higher E_{max} implied that the killer defects were suppressed, and quality of the grown diamond layer was improved by utilizing MAT technique. In addition, forward characteristics were fitted by thermionic emission (TE) theory and Tung's model in the temperature range from 300 to 480 K. The perfection of the Schottky-diamond interface was discussed. The results of this work indicating that heteroepitaxial substrates are a promising alternative for large-area low-cost diamond electronics [3].

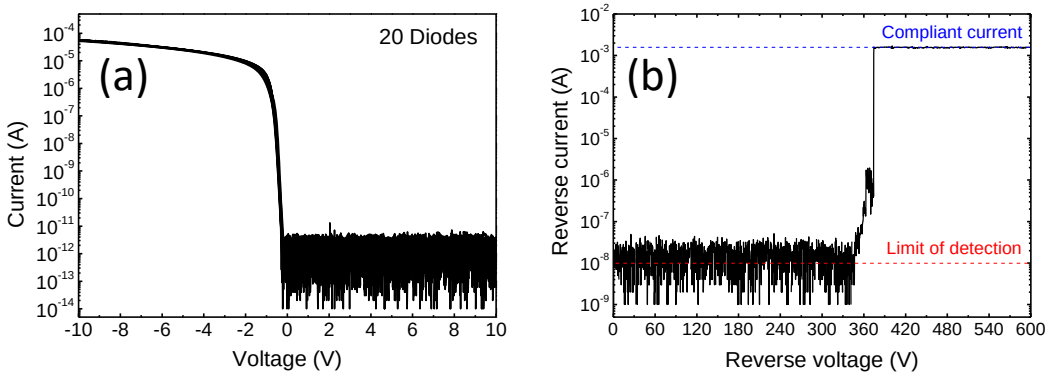

Fig. 1. (a) *I-V* characteristics and (b) reverse voltage characteristics of the fabricated diamond SBDs.

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Reference

[1] S. Ohmagari, *et al.*, Phys. Stat. Solidi A, 216, 1900498 (2019).

[2] H. Kawashima, *et al.*, Appl. Phys. Express, 8, 104103 (2015).

[3] P. Sittimart, *et al.*, Jpn. J. Appl. Phys. (2020) in press.