Charge deep-level transient spectroscopy of Al/intrinsic diamond/p^+-Si Schottky diodes

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Abstract. Charge deep-level transient spectroscopy (Q-DLTS) and the feedback charge capacitance method (FCM) were applied to Al/intrinsic diamond/p-Si diodes, using the top Al electrode as a Schottky gate. The Q-DLTS data recorded over the temperature range of 90-450 K could be split into two components: (i) a peak of the signal due to a discrete energy level, the hole emission of which is thermally activated by $\Delta E = 0.29 \pm 0.02$ eV; (ii) a broad spectrum of relaxation times manifesting itself as a signal that increases continuously on heating the diodes toward the ultimate temperature. To exclude any effects caused by the silicon back contact (Al), Q-DLTS spectra taken at different polarities of the filling pulse were compared. The related FCM capacitance-voltage measurements at the uppermost temperature revealed no changes in the capacitance with bias if sampling the time domain capacitance in the microsecond region. Over a longer timescale an excess capacitance was detected as expected on the basis of the complementary Q-DLTS data. Taking into account the absence of any capacitance changes at lower temperatures and/or short observation times (excitation), it is concluded that the defects reside in the polycrystalline diamond layer rather than at the diamond/silicon interface.

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