

A Comparison of Methods for Determination of Schottky Barrier Height and Ideality Factor Regarding the Contacts Based on Broad-Band Semiconductors

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Schottky barrier height (ShBH) and ideality factor (n) are the most important parameters of the Schottky contact. A number of methods for their determination, including determination from the current-voltage (I-V) characteristic, is well known. Attempts to generalize and systematize the existing methods were made in a number of papers [1, 2], but estimation of accuracy, carried out in the most of works, does not take into account the peculiarities of contacts to wide-gap semiconductors. Considering the accuracy of determining ShBH, as applied to the contacts based on wide-gap semiconductors, it is necessary to take into account three factors: the accuracy of measurements of initial values (current, voltage), accuracy of the approx method and accuracy of correlation between the proposed mechanism of charge transport and that implemented in reality.

In this work, a batch of Schottky diodes were investigated using different methods, a comparison of these results was made, and the reasons of their differences were discussed. Considering the series resistance and portion of I-V characteristics at $V \sim kT/q$ can contribute a substantial correction to the value of the determined series resistance, and therefore, the methods of Lien, Werner as well as direct approximation are preferable to determine the height of the potential barrier at the small extent of the exponential portion of the I-V characteristics. The values of ShBH, obtained by the method of activation energy and Sato, are only valid in the absence of the temperature dependence of ShBH. It has ascertained that an inconsistency between the real I-V characteristics and its model – the temperature dependence of the ShBH, n dependence on the voltage – introduces the basic error into the calculated parameters in the diode under study. It can be concluded that for the wide-gap semiconductors, at this stage of their study, the greatest accuracy is inherent to methods allowing to detect and identify a discrepancy between the model and measured data, namely, methods by Lien, Werner and Cheung. The necessity to study the temperature dependence of the ideality factor for correct determination of the mechanism responsible for the charge transfer and Schottky barrier height has been shown

1. V. Aubry, F. Meyer., *J. Appl. Phys.*, **76**(12), (1994), 7973.\
2. K. Sarpatwari. Toward understanding the electrical properties of metal/semiconductor Schottky contacts. PhD Diss. Pennsylv. St. Univ. (2009).