

The electric field fluctuations and the δ -layer broadening in semiconductors

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Delta-layers are objects in which all the impurities are grouped on a few (ideally on a single) crystal planes. Such structures have been thoroughly investigated during recent years. One of the problem being investigated is the δ -layer broadening in the process of its growing [1–3].

In studies of the δ -layer broadening the layer can be considered as a set of dot charges because the screening radius, especially at the growing temperature exceeds the characteristic layer width in tenth times. Thus near such a layer there should be an essential fluctuation of the electric field.

We have considered the electric field distribution function near the plane with randomly arranged dot charges and have shown that this distribution function is not a Gaussian one (see figure) and has an uncommon shape. It has a long tail which is to say that there are profound fluctuation of the electric field near the δ -layer. It is apparent that this fluctuation significantly exceed the mean field value and it should result in the final impurities distribution.

Using the numerical simulation of the impurity diffusion we have shown that the salient features of the distribution function can cause the non-Gaussian (non-Poisson) impurities distribution in the transversal to the δ -layer direction.

The origination of this phenomenon lies in the fact that impurities which occur in the area with the large electric field quickly run away from the δ -layer forming the expanded wings of the final impurities distribution which cannot be fit by the Gaussian distribution function.

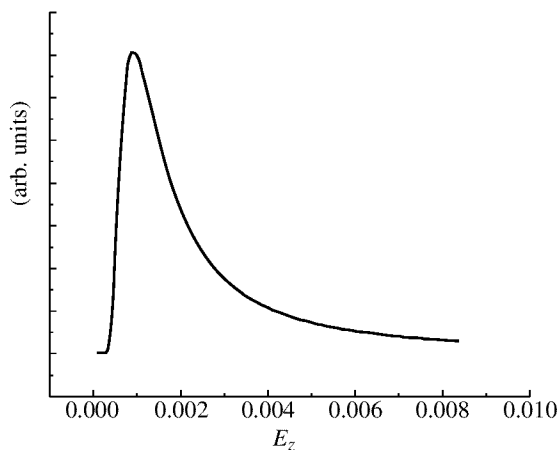


Fig. 1.

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References

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