# Study of charge transport mechanisms in 2D/3D junctions

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Abstract

Unique properties of graphene-semiconductor junctions offer a great opportunity to investigate new fundamental phenomena taking place at the interface between a two-dimensional (2D) semimetal and a three-dimensional (3D) bulk semiconductor and make this junction extremely attractive for a new generation of graphene-based devices. One of the key issues in these junctions is to understand the charge transport mechanisms. In this work [1-3], we focus on a systematic analysis of charge transport mechanisms in the junctions formed by a 3D oxide semiconductor ($Ga_2O_3$ and ZnO) and 2D graphene. We further attempt to deeply understand how the interaction between graphene and different crystallographic planes of oxide semiconductors affect the charge transport.

## References

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[2] S. Tiagulskyi, O. Černohorský, N. Bašinová, R. Yatskiv, J. Grym, Materials Research Bulletin, 164 (2023) 112286.
[3] S. Tiagulskyi, R. Yatskiv, H. Faitová, O. Černohorský, J. Vaniš, J. Grym, Physica E: Low-dimensional Systems and Nanostructures, 136 (2022) 115006.

## Figures

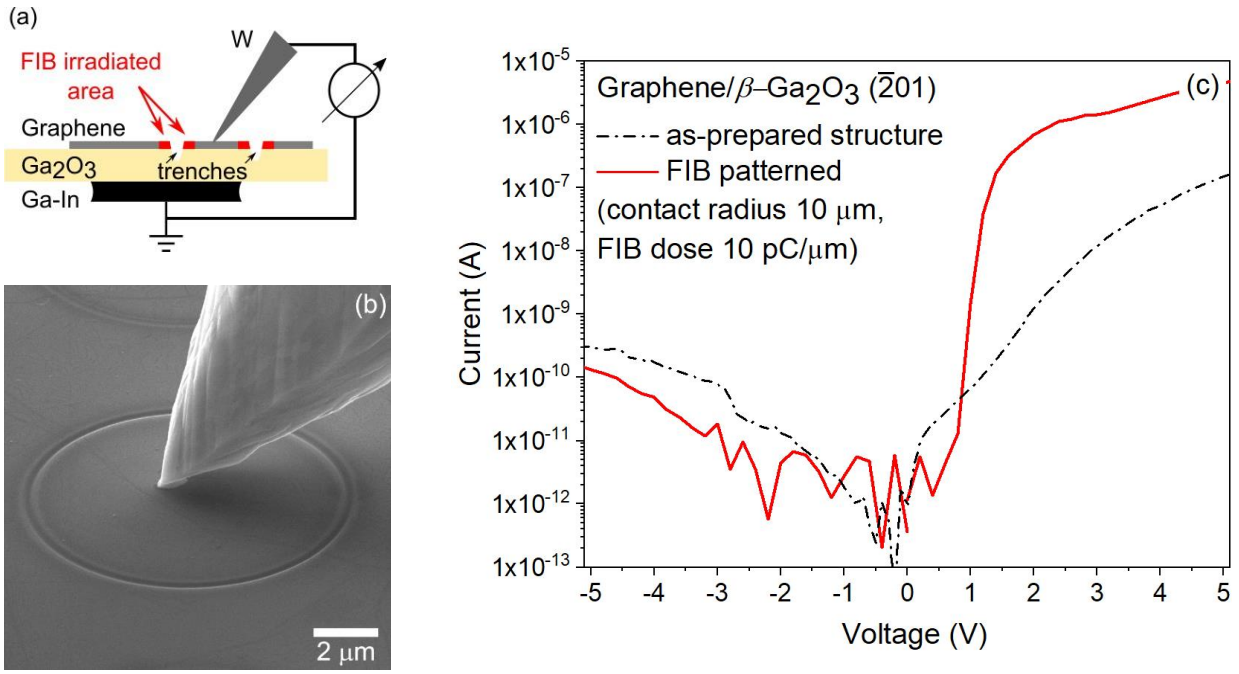


**Figure 1:** (a) The cross-sectional view of the graphene/β-$Ga_2O_3$ structure under the in-situ SEM I-V characterisation. The graphene surface is contacted by the W tip of nanomanipulator and β-$Ga_2O_3$ is grounded via the In-Ga bottom contact. The circular trench was milled by the focused $Ga^+$ ion beam; (b) An SEM image of the nanomanipulator needle contacting the graphene surface carved by FIB milling; (c) I-V characteristics of the as-prepared and the FIB-patterned graphene/β-$Ga_2O_3$ structures on the ($\bar{2}01$) surfaces of β-$Ga_2O_3$ substrates.