7.标题: Effects of oblique wave propagation on the nonlinear plasma resonance in the two-dimensional channel of the Dyakonov-Shur detector
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摘要: In the Dyakonov-Shur terahertz detector the conduction channel of a heterostructure High Electron Mobility Transistor (HEMT) is used as a plasma wave resonator for density oscillations in electron gas. Nonlinearities in the plasma wave propagation lead to a constant source-to-drain voltage, providing the detector output. In this paper, we start with the quasi-classical Boltzmann equation and derive the hydrodynamic model with temperature dependent transport coefficients for a two-dimensional viscous flow. This derivation allows us to obtain the parameters for the hydrodynamic model from the band-structure of the HEMT channel. The treatment here also includes the energy balance equation into the analysis. By numerical solution of the hydrodynamic equations with a non-zero boundary current we evaluate the detector response function and obtain the temperature dependence of the plasma resonance. The present treatment extends the theory of Dyakonov-Shur plasma resonator and detector to account for the temperature dependence of viscosity, the effects of oblique wave propagation on detector response, and effects of boundary current in two-dimensional flow on quality of the plasma resonance. The numerical results are given for a GaN channel. We also investigated a stability of source to drain flow and formation of shock waves. Published by Elsevier Ltd.
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