Effective Mass and g-Factor of two-dimentional HgTe Γ_8-band electrons: Shubnikov-de Haas oscillations

© V.N. Neverov[1], A.S. Bogolubskii[1], S.V. Gudina[1], S.M. Podgornykh[1,2], K.V. Turutkin[1], M.R. Popov[1], N.G. Shelushinina[1], M.V. Yakunin[1,2], N.N. Mikhailov[3], S.A. Dvoretsky[3]

[1] Miheev Institute of Metal Physics of Ural Branch of Russian Academy of Sciences,
620990 Ekaterinburg, Russia
[2] Ural Federal University,
620002 Ekaterinburg, Russia
[3] Rzhanov Institute of Semiconductor Physics of Siberian Branch of Russian Academy of Sciences,
630090 Novosibirsk, Russia

E-mail: neverov@imp.uran.ru

Received April 15, 2020
Revised April 21, 2020
Accepted April 21, 2020

We present a study of Shubnikov-de Haas (SdH) oscillations at temperatures of $(2.2-10)$ K in magnetic fields up to 2.5 T in the HgCdTe/HgTe/HgCdTe heterostructure for a wide (20.3 nm) HgTe quantum well with an inverted energy band structure. The analysis of the temperature dependence of SdH amplitude in weak fields, in a region of doubly degenerate magnetoresistance peaks, led us to the value of effective electron mass $m_c/m_0 = (0.022 \pm 0.002)$ which is about half the theoretical estimates. But in a region of higher magnetic fields, for nondegenerate magnetoresistance peaks, we confidently have $m_c/m_0 = (0.034 \pm 0.003)$ in good agreement both with the theoretical estimation and with our experimental results on the analysis of activation transport under quantum Hall effect regime. The reasons for this discrepancy are discussed.

Keywords: quantum wells, mercury telluride, Shubnikov-de Haas oscillations, effective mass of charge carriers, quantum Hall effect.

Full text of the paper will appear in journal SEMICONDUCTORS.