Properties of Schottky Contacts on Laser-Modified Surface of CdZnTe

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The surface modification in semiconductors under pulsed laser radiation is increasingly used in opto-and nanoelectronics. By changing the laser processing condition (intensity, duration and repetition rate of laser radiation) the surface structures with characteristic lateral and vertical dimensions ranged from nano- to micrometers can be obtained.

The samples used for the investigations were monocrystalline semi-insulating $Cd_{0.9}Zn_{0.1}Te$ with resistivity (1-2) 10^{10} Ω cm at room temperature. The preparation of samples included mechanical grinding and polishing, followed by chemical-mechanical polishing in bromine-methanol etchant. The samples were irradiated by the second harmonic (λ = 532 nm) of a Nd:YAG laser with a pulse duration of 10 ns, 5 MW/cm^2 intensity and repetition frequency of 10 Hz. To modify the surface approximately 10^3 pulses were used at each point.

The surface barrier structures have been prepared by electroless deposition of Au at room temperature and thermal evaporation of In on samples heated to 120 °C. The diode-like current-voltage characteristics was observed in Au and In contacts deposited on irradiated and non-irradiated surfaces, respectively. The selective photoresponse peaked at 0.79 μm was observed in In contacts on the non-irradiated surface, whereas additional wide spectral bands peaked at 0.55-0.63 μm were observed in Au contacts. The polarity of the measured signals was analysed to determine the conductivity type of these surfaces.

It has been found that the starting material has p-type conductivity and pulsed laser irradiation results in formation of surface layer with n-type conductivity. The conductivity type inversion occurs on the depth of several microns. The broadening of the photovoltaic response in the Au contacts arises due to appearance of the graded-gap region at the surface.

The observed conversion of the conductivity type is not trivial, since it is generally accepted that the laser irradiation results in formation of cadmium vacancies (stoichiometry violation). Possible reason for the conversion is generation of large amount of dislocations. The presence of the dislocation network at the surface can also explain the observed power dependence of the dark current on temperature. In such a case, the percolation conductivity through the dislocation network can be dominant.