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Ohmic Contacts to Al–Implanted ZnSe

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Ohio Contacts to Al-Implanted ZnSe

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The production and characterization of ohmic contacts is an important part of semiconductor technology. In this paper we report the formation of ohmic contacts on ZnSe, by evaporating or sputtering Au or Pt onto the Al-implanted, n-type substrate. Although these metals normally form rectifying Schottky barriers on n-type ZnSe, such barriers are precluded if the implanted layer is degenerate. An advantage of Au or Pt contacts is that much higher operating temperatures are possible than with the commonly used In or Ga.

The Al implantation was carried out at 20 keV to a dose of 10^{15} ions/cm^2 at room temperature. The substrate was a high-resistivity (~10^8 ohm-cm) crystal cut to expose the (110) face. Before implantation, the surface was mechanically polished and chemically etched at 90°C for 1 min in a mixture of 2 parts H_2SO_4 and 3 parts saturated aqueous solution of K_2Cr_2O_7, followed by a 20 sec rinse in a boiling 25% solution of NaOH. In a previous paper (1) it was reported that crystals implanted in such a manner and annealed in evacuated fused-silica ampuls for 4 hr at 900°C showed nearly degenerate electrical characteristics, with an effective electron mobility of about 4 cm^2/V·sec and an effective sheet carrier concentration of about 10^{18} cm^{-2}. When unimplanted samples and samples implanted with Ar ions were annealed under the same conditions, they remained highly resistive. This showed that the Al implantation was essential for the production of the conductive layer, i.e., neither the annealing alone nor the radiation damage produced by Ar ions were sufficient to appreciably change the conductivity of the original substrate. The thickness of the implanted and annealed conductive layer was roughly checked by the use of the etch described above. This etch removes about 50 Å/sec from unimplanted ZnSe at room temperature and the rate for implanted ZnSe

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3 Key words: metal-semiconductor contacts, contact resistance, ion implantation.
4 The ion implantation was done at NASA Langley Research Center.
The Semiconductive Property of Gamma-Ferric Oxyhydroxide

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The recent investigations by Cohen et al. on the passive films deposited upon iron or platinum from neutral ferrous sulfate solution (1) or ferrous perchlorate solution (2) strongly suggest that the composition of these films corresponds to crystalline $\gamma$-FeOOH. It appears that the electrical properties of FeOOH-type oxides have not been studied extensively, although the ultimate characteristics of such substances should have significant implications for the function of surface films.

In the preceding study on the electrical properties of ferric oxyhydroxides (3), the present authors found that $a$-, $\beta$-, and $\gamma$-FeOOH are semiconductors which show d-c conductivity in the order of $10^{-9}$ ohm$^{-1}$ cm$^{-1}$ and high-frequency (7 MHz) conductivity of $10^{-6}$-$10^{-7}$ ohm$^{-1}$ cm$^{-1}$ and which probably have negative carriers. The appropriate value of conductivity obt