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Electrical Resistivity of Ti-Ga-P Thin Films Synthesized by Asymmetric Bipolar Pulsed-DC Magnetron Sputtering

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The electrical resistivity of thin films of Ga-P-Ti alloys, deposited on glass substrates by an asymmetric bipolar pulse-dc magnetron sputtering method under Ar atmosphere, has been investigated. The sputtering targets containing compacted GaP powder and metallic titanium sheet with the surface ratio GaP:Ti of 8:1, 5:1, 2:1 and 1:1 were employed. The electrical resistivity of the deposited thin films was measured using the standard van-der-pauw four probe technique under dark and illumination with white light of 70,000 lux conditions. It was found that, under dark condition, the electrical resistivity increases from 7.547E-1 to 9.469E+1 Ω.m for the films deposited from the target having GaP:Ti of 8:1 and 5:1, before sharply reduces to 1.538E-4 and 3.899E-5 Ω.m for the films obtained from the targets having GaP:Ti of 2:1 and 1:1, respectively. The electrical resistivity measured under the lighting condition shows the similar trend. The results indicated that the thin film from the targets having GaP:Ti of 8:1 and 5:1 are semiconductor-like while those from the targets having GaP:Ti of 2:1 and 1:1 are metal-like. The observed behaviors agree well with those found from optical property measurement carried out early. However, the changes of electrical resistivity in responses to lights are inconclusive.

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