ELECTROPHYSICAL PROPERTIES OF THIN FILMS Mn_4Si_7

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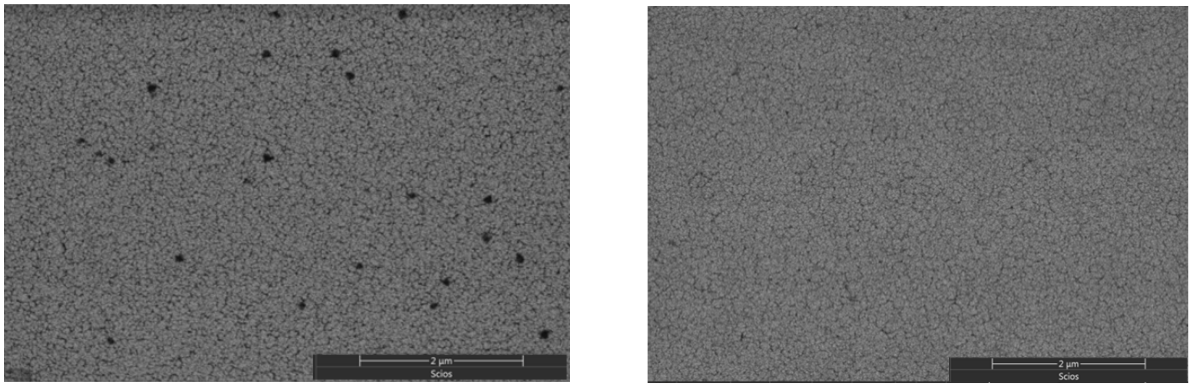
Mn_4Si_7/Si(111) films were grown by ion-plasma sputtering using argon ions. Their electrical conductivity and electrical resistance were studied as a function of temperature, and the ratio of HSM thin films was also carried out.

The Mn_4Si_7 film formed by magnetron sputtering is in the amorphous state (Fig. 1a) and the polycrystalline state (Fig. 1b) before thermal heating.



a) b)

Figure 1. Mn_4Si_7 film before heating (a) and after heating at a pressure of 10^{-3} Pa at a temperature of T = 800 K (b).

In the amorphous state, the resistance of the film is greater than the resistance in the polycrystalline state. This is due to the fact that the bond between the manganese and silicon atoms is very weak and there are defects on the surface areas that are not completely covered. The resistance of a HCM film grown on the surface of *p*- type semiconductor silicon has a non-linear character on the temperature dependence graph, which means that it is, by its nature, semi-metallic. The electrical conductivity of the Mn_4Si_7/Si(111) film 102.3 nm thick, measured at room temperature, is 1078.5 $\Omega^{-1}\cdot cm^{-1}$, and the electrical resistance is 111.5 Ω.

Silicon and manganese atoms deposited on silicon oxide almost completely cover the substrate. As a result of experiments with this film, it was found that it has metallic properties.

Thin nanometer Mn_4Si_7/Si(111) layers grown by the ion-plasma method were also formed on various silicon substrates at different growth temperatures. The electrical conductivity, power factor and electrical resistance of the resulting Mn_4Si_7/Si(111) layers of various thicknesses were analyzed in the temperature range of 300 – 600 K. The highest value of the power factor is 1580.5 $\mu W/m\cdot K^2$ at 500 K. /Si(111) is 800 K. The results show that the electrical conductivity increases with decreasing film thickness on the silicon surface. This fact can be used to increase the sensitivity of IR receivers.