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Ultra-thin and thin CrSi films on Si(111):

II. Transport and magnetic properties

Nikolay G. Galkin[1,*], *Evgenii Yu. Subbotin*[1], *Konstantin N. Galkin*[1], *Dmitrii L. Goroshko*[1], *Olga A. Goroshko*[1], *Dmitri B. Migas*[2,3], *Andrew B. Filonov*[2], *Ivan A. Tkachenko*[4], *Aleksei Yu. Samardak*[5]

[1] Institute of Automation and Control Processes, FEB RAS, Radio Str. 5, Vladivostok, Russia

[2] Belarusian State University of Informatics and Radioelectronics, P. Browki 6, 220013 Minsk, Belarus

[3] National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe shosse 31, 115409, Moscow, Russia

[4] Institute of Chemistry FEB RAS, Prospect 100-letiya Vladivostoka, 159, Vladivostok, Russia

[5] Far Eastern Federal University, Campus, 10 Ajax Bay, Russky Island, 690922, Vladivostok, Russia

*(e-mail): galkin@iacp.dvo.ru

SUPPLEMENTARY MATERIALS

Fig. 1S

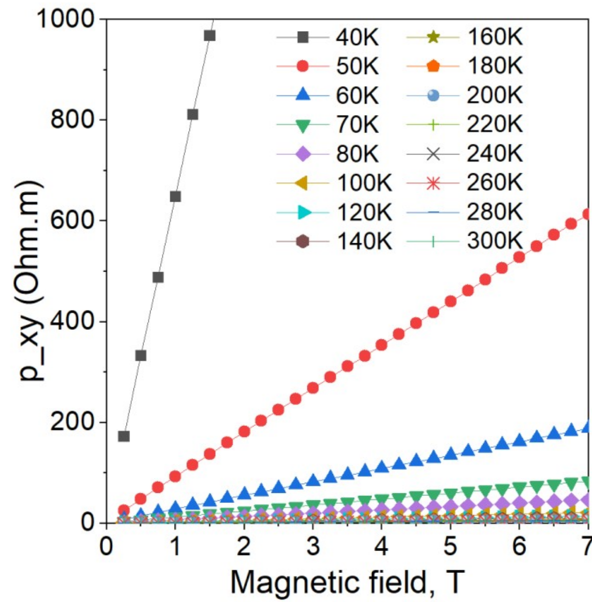
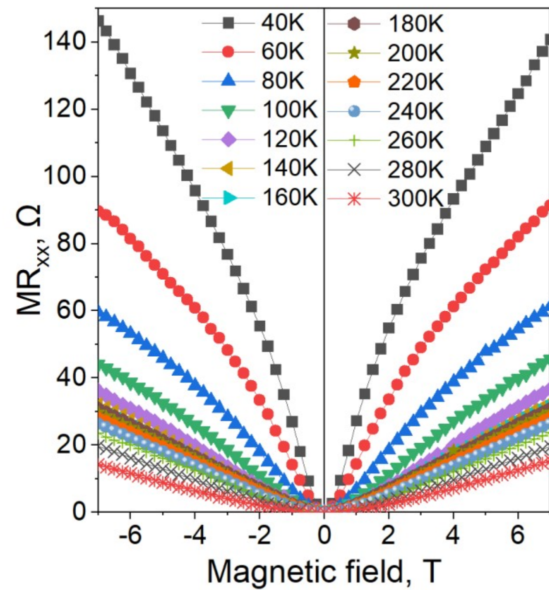
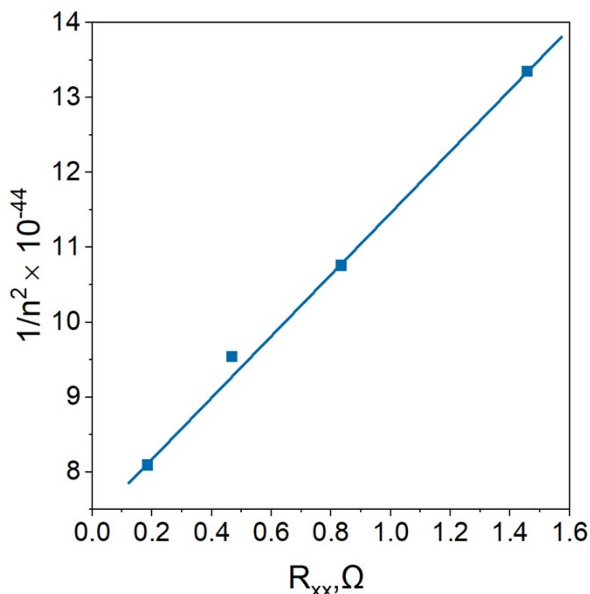


Fig. 2S



The additional Hall measurements of the *n*-type silicon substrate (FZ1000) after its high-temperature annealing at 1150° *C* in a high-vacuum camera were done in the Teslatron TP setup. The linear field dependences of Hall resistivity (Fig. 1S) were observed in the applied magnetic field from 0.5 T to 8.0 T and temperatures from 40 K to 300 K. The n- to p-type conductivity switching occurred after the substrate annealing as confirmed by the Hall coefficient data versus temperature in applied magnetic fields from 0.25 to 8.0 T (not shown). The magneto-resistance field dependence data (Fig. 2S) confirm the non-linear process below 100 K which connected with hole and electron redistribution between layers in the substrate with a p-n junction. There are strong non-linear dependences, whereas the parabolic $MR_{xx}(B)$ preserved only at above 270 K.

Fig. 3S



The resistivity tensor components which obtained from the main equation of the Abrikosov's model [A. A. Abrikosov, Europhys. Lett., 2000, 49, 789–793] are:

$$\rho_{xx} = \rho_{yy} = \frac{N_i H}{\pi n^2 ec} \propto H,$$

The carrier concentration (n) in the film was obtained from the slope of the UT CrSi film magneto-resistance versus magnetic field (Fig. 3b) at 3 – 30 K and its square reciprocal value versus the magneto-resistance was plotted (Fig. 3S). The scattering center (neutral impurities or defects) concentration (N_i) was assumed to be a constant. As seen (Fig. 3S), the obtained R_{xx} versus $1/n^2$ dependence corresponds to the magneto-resistance quantization below 30 K in the fields of 0.25 – 7.0 T for the UT CrSi film. Some carrier concentration changes in magnetic field in semimetal can be due to changes in the Fermi level position.