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An STM Study of Na_xCoO_2(x=0.84) Surface

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The properties of the Na_xCoO_2 class of materials are interest from a number of viewpoints. Two metallic phases at low and high dopings are separated by an insulating state at x=0.5. A superconductivity for $Na_{0.3}CoO_2$ when it is intercalated with water, a high thermoelectric-power Curie-Weiss metallic paramagnet is found for $Na_{0.7}CoO_2$. We report the first direct real-space STM study on a $Na_{0.84}CoO_2$ surface, as prepared by *in-situ* cleaving in ultra high vacuum. Two categories of ordering phenomena were discovered. First, three Na ordered patterns, with $p(\sqrt{7} \times \sqrt{7})$, $p(3 \times 3)$, or $p(2\sqrt{3} \times 2\sqrt{3})$ unit cells, were resolved. These patterns are ascribed to Na ordering. Second, a new phase of one-dimensional stripes was identified. This stripe phase exists on the surface and in the bulk crystal.

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Detection of Inverse Spin-Hall Effect in Palladium

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The inverse-spin-Hall effect (ISHE), conversion from a spin current into a charge current, was observed in a $Pd/Ni_{81}Fe_{19}$ bilayer using the spin pumping operated by ferromagnetic resonance (FMR). In spite of an important role inspintronic devices, the methods for generation and detection of spin currents are yet to be established. ISHE is a promising method for detecting spin current electrically, and therefore ISHE enables us to integrate spintronic devices into the conventional electronics technology[1]. We have investigated ISHE induced by the spin pumping that generates a pure spin current using FMR without an electric current. However, up to now, we observed significant ISHE signals using the spin pumping only in a $Pt/Ni_{81}Fe_{19}$ bilayer[2]. Here, we report Pd is also an ideal material for inducing ISHE.

The sample used in this study is a Pd (10 nm) /$Ni_{81}Fe_{19}$ (10 nm) bilayer which was deposited by electron-beam evaporation using different patterns of metal masks for each layer. Pd has been expected to cause a considerable spin-Hall signal via the intrinsic spin-Hall mechanism. The FMR and the sample-voltage signal were measured with a sweeping magnetic field using a 9.4 GHz microwave.

Figure 1 shows the results of the measurement. The solid line in the upper inset represents the FMR lock-in signal and the open circles represent the sample-voltage lock-in signal; note that these signals are the differential of the original FMR absorption and sample voltage signals. Since both the signals appear at the same field value and exhibit similar peek-dip-shaped curves, the sample voltage is attributed to ISHE.

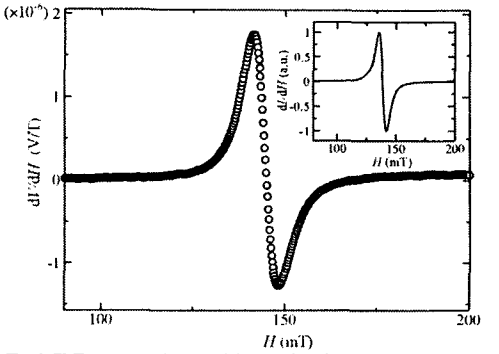

Fig. 1. FMR spectrum (inset) and the sample-voltage lock-in spectrum.

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