

Transport, Magnetization and XAS Study of Ca Doped $\text{BaNi}_x\text{Co}_{1-x}\text{S}_{2-y}$

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$\text{BaCo}_{1-x}\text{Ni}_x\text{S}_{2-y}$ is one kind of layer compound with metal-insulator transition. The transition temperature varied in hundred Kevn range depends on Ni and S concentration. Here is the first report as we know in the world to make Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$ successful. The bulk samples were prepared specially by vacuum procedure. This new sulfide compounds have Metal-Semiconductor transition at high temperature as shown in Fig. 1 and 2. The result show the transition temperature, magnetization, and resistance can be controlled by Ca concentration.

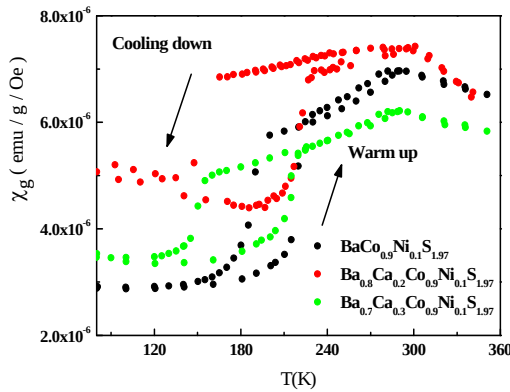


Fig. 1: Magnetization of Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$

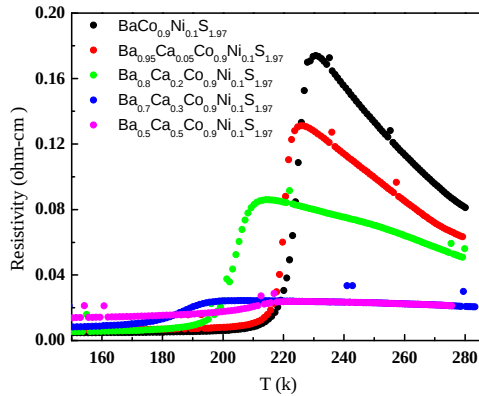


Fig. 2: Resistivity of Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$

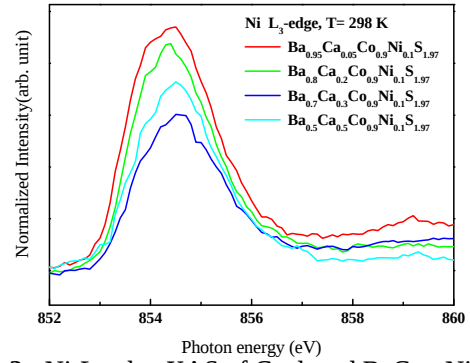


Fig. 3: Ni L_3 edge XAS of Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$

Co and Ni L_3 -edge x-ray absorption spectrum (XAS) measurement with electron yield were carried out at the 11A dragon beamline of NSRRC in Taiwan. Both show the white line shape and peak energy shift to high energy with Ca concentration. The more splitting of e_g - t_{2g} orbital indicated the increasing of crystal field due to the $\text{Co}^{2+}/\text{Ni}^{2+}$ ion local structure distortion by Ca doping.

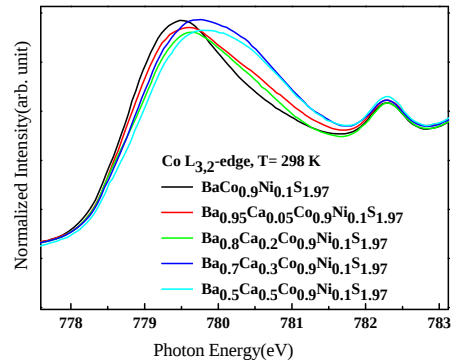


Fig. 4: Co L_3 edge XAS of Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$

Summary:

Here is the first report as we know in the world to make Ca doped $\text{BaCo}_{0.9}\text{Ni}_{0.1}\text{S}_{1.97}$ successful. The transition temperature can be controlled by Ca doping in hundred Kevn range. As the follow XAS spectrum we measured. We proved the valence electron redistribution between 3d orbital as expected by Ca doping.