(6a6)

Elastic anomaly at extreme low temperatures in $SmRu_4P_{12}$

Y.Nakanishi [1], T. Tanizawa [1], M. Yoshizawa[1], M. Oikawa[2], A. Sugihara[2], T. Fujino[2], T. Ogasawara[2], Y. Konno[2], S. R. Saha[3], H. Sugawara[4], Y.Aoki[5] and H. Sato[5]

[1]Graduate School of Frontier Materials Function Engineering, Iwate University, Morioka, 020-8551, Japan

[2]Department of Matyerials Science and Engineering, Iwate University, Morioka, 020-8551, Japan

[3]High Energy Accelerator Research Organization (KEK) 1-1 Oho, Tsukuba, Ibaraki 305-0801, Japan

[4]Faculty of Integrated Arts and Sciences, The University of Tokushima, Tokushima 770-8502, Japan

[5]Graduate School of Science, Tokyo Metropolitan University, Hachioji, 192-0397, Japan

Ultrasonic measurement was performed on $SmRu_4P_{12}$ to investigate the elastic property at low temperatures. $SmRu_4P_{12}$ exhibits a metal-insulator (MI) transition at 16 K, accompanied a magnetic phase transition. Our recent investigations made clear the elastic behavior around MI transition. A steep decrease of elastic constants $(C_{11}\text{-}C_{12})/2$ and C_{44} was observed at 16 K due to the MI transition. The elastic constant shows an increase below around 10 K, followed by a maximum at around 2 K. Very recently, a clear elastic softening was found below about 2 K down to 0. 5 K by our group. To obtain the whole behavior and elucidate the origin, the elastic constants were measured in the lower temperature down to 0.06 K with a dilution refrigerator. Figure 1 shows the temperature dependence of elastic constant $(C_{11}\text{-}C_{12})/2$ measured in the temperature down to 0.06 K. A clear softening was observed below 2 K. It should be highlighted that $(C_{11}\text{-}C_{12})/2$ reaches a constant value below 0.3 K, finally. It is difficult to explain the origin of the softening observed below 2 K in a framework of a conventional picture based on crystalline electric field (CEF) effect, since a degeneracy of 4f ground state of Pr ion would be lifted by MI transition. At present we believe that this softening may be ascribed to the coupling between sound strain and quasi-particles formed by a strong hybridization. We will show our recent results of them and discuss the origin of the pronounced softening in $(C_{11}\text{-}C_{12})/2$ below around 2 K from that viewpoint.

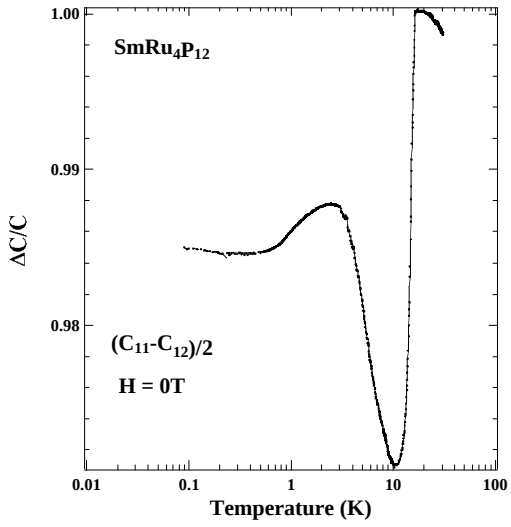

Figure 1: Temperature dependence of the elastic constant $(C_{11}\text{-}C_{12})/2$ of $SmRu_4P_{12}$