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Non-magnetic Ground State of a Pr-based Caged Compound $PrRu_2Zn_{20}$ TAKAHIRO ONIMARU, KEISUKE MATSUMOTO, YUKIHIRO F. INOUE, KAZUNORI UMEO, YUTA SAIGA, TOSHIRO TAKABATAKE, Hiroshima University, YOSHITAKA MATSUSHITA, National Institute for Materials Science, KAZUE NISHIMOTO, RYUJI TAMURA, Tokyo University of Science — Recently there has been considerable interest in rare-earth based compounds with caged structures, because they show a variety of ground states originating from the caged structures, for example, heavy-fermion superconductivity in $PrOs_4Sb_{12}$, a phase transition attributed to scalar-type multipolar degrees of freedom in $PrFe_4P_{12}$, etc. We have studied Pr-based caged compounds of $PrRu_2Zn_{20}$ crystallizing in the cubic $CeCr_2Al_{20}$-type structure, where a Pr-ion is encapsulated in a cage formed of sixteen zinc atoms. In analogy of the filled-skutterudite structure, the large coordination number of the Pr-ion, CN=16, suggests weak crystalline electric field (CEF) effect and strong hybridization of the cage and f electrons of the Pr-ion. In $PrRu_2Zn_{20}$, the magnetic susceptibility obeys the Curie-Weiss law above 25 K, suggesting the trivalent state of the Pr-ion suffering from weak CEF effect. A Schottky peak of the specific heat appearing at 2.5 K is the manifestation of a first excited state located around 7 K above the CEF ground state. No phase transition has been observed down to 0.4 K, indicating the non-mangnetic singlet ground state.

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