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Low temperature specific heat of $Ba_{8-x}Eu_xGe_{43}$

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Compounds with Kondo insulating behavior and cage-like structures are promising candidates for thermoelectric applications. In search for such materials we partially substituted Ba by Eu in the defect clathrate $Ba_8Ge_{43}\square_3$. Eu randomly replaces part of the Ba ions in the smaller cages of the network. The magnetic susceptibility χ of $Ba_{8-x}Eu_xGe_{43}$ ($x = 0.3$, 0.6) revealed no magnetic ordering above 2 K. Measurements of specific heat c_P indicate the absence of a magnetic transition even down to 350 mK. However, the low temperature specific heat strongly depends on the Eu content x. c_p/T vs. temperature T shows an upturn below 7 K, which is more pronounced for higher x. From investigations of c_p in magnetic fields up to 9 T we conclude that this upturn is caused by depopulation of the $4f^7\ ^8S_{\frac{7}{2}}$ octet of the Eu^{2+} ions resulting in a Schottky-like anomaly. The random Eu distribution leads to frustration and prevents magnetic ordering in the investigated temperature range.

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