The Solid Solution CeAuIn$_{1-x}$Mg$_x$ – Structure, Magnetic Properties and Specific Heat Data

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Four different samples of the solid solution CeAuIn$_{1-x}$Mg$_x$ with $x = 0.2, 0.4, 0.6$, and $0.8$ have been prepared from the elements in sealed tantalum tubes in an induction furnace. The samples were characterized through X-ray powder and single crystal data: ZrNiAl type, $P\bar{6}m2$, $Z = 3$, $a = 774.54(7)$, $c = 420.32(10)$ pm, $wR^2 = 0.0203$, 395 $F^2$ values, 15 variables for CeAuIn$_{0.871}$Mg$_{0.129}$, $a = 775.25(7)$, $c = 419.36(10)$ pm, $wR^2 = 0.0488$, BASF = 0.10(1), 397 $F^2$ values, 16 variables for CeAuIn$_{0.640}$Mg$_{0.360}$, $a = 774.62(7)$, $c = 420.13(10)$ pm, $wR^2 = 0.0435$, 376 $F^2$ values, 15 variables for CeAuIn$_{0.445}$Mg$_{0.555}$, $a = 773.80(11)$, $c = 420.82(8)$ pm, $wR^2 = 0.0415$, 392 $F^2$ values, 15 variables for CeAuIn$_{0.228}$Mg$_{0.772}$. The lattice parameters show no pronounced changes within the solid solution. The largest shift occurs for the $x$ parameter of the mixed occupied In/Mg positions. Due to the difference in size, the trigonal prisms around the Au1 atoms at the origin become smaller with an increasing content of magnesium. The In/Mg–In/Mg distances decrease from 334.5 (CeAuIn$_{0.871}$Mg$_{0.129}$) to 328.3 (CeAuIn$_{0.228}$Mg$_{0.772}$) pm, and consequently one observes also shorter bonds to the Au1 atoms with an increasing content of magnesium concentration. Susceptibility measurements reveal trivalent cerium for all CeAuIn$_{1-x}$Mg$_x$ compounds, with no evidence sign of magnetic ordering down to 2 K. The disorder created by chemical substitution destroys the long-range magnetic ordering which can be attributed to the triggering of non Fermi-liquid (NFL) like behavior.

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