

# Intermetallic Cerium Compounds with Ordered $U_3Si_2$ Type Structure

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New intermetallic cerium compounds  $Ce_2T_2Mg$  ( $T = Ni, Cu, Pd$ ),  $Ce_2T_2Cd$  ( $T = Pd, Pt, Au$ ), and  $Ce_2T_2Pb$  ( $T = Pt, Au$ ) were prepared by reaction of the elements in sealed tantalum tubes in a high-frequency furnace. Most  $Ce_2T_2X$  ( $X = Mg, Cd, Pb$ ) compounds are stable after annealing at about 1000 K, while  $Ce_2Pd_2Mg$  is obtained as single phase only after melting and quenching. A thermal treatment at about 1000 K leads to decomposition in  $CePdMg$  and  $CePd$ . The eight compounds were investigated by X-ray diffraction both as powders and single crystals, and most structures were refined from single crystal data. They adopt an ordered  $U_3Si_2$  type structure with space group  $P4/mbm$ :  $a = 759.6(1)$ ,  $c = 376.71(9)$  pm,  $wR2 = 0.0562$ , 294  $F^2$  values, 12 parameters for  $Ce_2Ni_2Mg$ ,  $a = 787.41(9)$ ,  $c = 387.23(7)$  pm,  $wR2 = 0.0438$ , 222  $F^2$  values, 12 parameters for  $Ce_2Cu_2Mg$ ,  $a = 777.14(8)$ ,  $c = 400.03(7)$  pm,  $wR2 = 0.0276$ , 221  $F^2$  values, 13 parameters for  $Ce_2Pd_{2.03}Mg_{0.97}$ ,  $a = 777.90(6)$ ,  $c = 393.28(6)$  pm,  $wR2 = 0.0360$ , 317  $F^2$  values, 12 parameters for  $Ce_2Pd_2Cd$ , and  $a = 779.90(7)$ ,  $c = 389.97(7)$  pm,  $wR2 = 0.0453$ , 315  $F^2$  values, 12 parameters for  $Ce_2Pt_2Cd$ . Refinement of the occupancy parameters revealed full occupancy for most sites. A mixed palladium/magnesium (97 % Mg / 3 % Pd) occupancy was observed only for the  $2a$  site of  $Ce_2Pd_{2.03}Mg_{0.97}$ , indicating a small homogeneity range for this compound.  $Ce_2Au_2Cd$  ( $a = 804.93(7)$ ,  $c = 393.36(6)$  pm) and the plumbides  $Ce_2Pt_2Pb$  ( $a = 794.63(7)$ ,  $c = 381.50(6)$  pm) and  $Ce_2Au_2Pb$  ( $a = 810.70(7)$ ,  $c = 394.85(7)$  pm) were characterized through their Guinier powder data. The structures of the  $Ce_2T_2X$  compounds can be interpreted as an intergrowth of distorted  $AlB_2$  and  $CsCl$  related slabs of compositions  $CeT_2$  and  $CeX$ . The course of the lattice parameters and chemical bonding within the series of  $Ce_2T_2X$  compounds are briefly discussed.