

Ferromagnetic ordering in novel ternary germanides: $\text{URu}_{1-x}\text{Ge}_2$ and $\text{U}_{34}\text{Ru}_{4-x}\text{Ge}_{33}$

M. Pasturel¹, **D. Kaczorowski**², **O. Tougait**¹, **A.P. Pikul**², **H. Noël**¹

¹ *Sciences Chimiques de Rennes, Chimie du Solide et Matériaux, Université Rennes 1,
UMR CNRS 6226, Campus de Beaulieu, 35042 Rennes Cedex, France,
e-mail: mathieu.pasturel@univ-rennes1.fr*

² *Institute of Low Temperature and Structure Research, Polish Academy of Sciences,
P.O.Box 1410, 50-950 Wrocław 2, Poland*

Several binary or ternary uranium based germanides have been reported to exhibit superconductivity at low temperatures, that emerges either from paramagnetic state (e.g. U_7Ge , U_5Ge_3 [1]) or from ferromagnetically ordered state, in ambient pressure conditions (e.g. URhGe [2], UCoGe [3]) or under applied hydrostatic pressure (e.g. UGe_2 [4]). In the search for other germanides with interesting physical properties, we have recently focused on the ternary system U-Ru-Ge. So far, crystal structures and physical properties of four phases from this system have been reported, namely for: $\text{U}_4\text{Ru}_7\text{Ge}_6$ [5], $\text{U}_3\text{Ru}_4\text{Ge}_{13}$ [6], URuGe [7] and $\text{U}_2\text{Ru}_3\text{Ge}$ [8].

In the present contribution we report on our discovery of two novel compounds: $\text{URu}_{1-x}\text{Ge}_2$ and $\text{U}_{34}\text{Ru}_{4-x}\text{Ge}_{33}$. The crystal structures of both phases have been determined by means of single crystal X-ray diffraction. The former phase crystallizes with a monoclinic unit cell of lattice parameters $a = 4.098(1)$ Å, $b = 15.936(2)$ Å, $c = 4.045(1)$ Å and $\beta = 90.09(1)^\circ$, which is a derivative of the orthorhombic $\text{CeNi}_{1-x}\text{Si}_2$ type structure. The other compound adopts a tetragonal structure of the $\text{U}_{34}\text{Fe}_{4-x}\text{Ge}_{33}$ type [$a = 10.8933(1)$ Å and $c = 25.3401(3)$ Å], which may be derived from the binary USi-type unit cell.

The physical properties of both compounds have been studied by means of dc- and ac-magnetization, electrical resistivity and specific heat measurements. Both germanides have been found to order ferromagnetically at $T_c = 62(1)$ K and $38.5(5)$ K, for $\text{URu}_{1-x}\text{Ge}_2$ and $\text{U}_{34}\text{Fe}_{4-x}\text{Ge}_{33}$, respectively. The obtained results will be comprehensively discussed at the conference with respect to some characteristic structural features, and in comparison to the physical properties of related compounds.

References

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