Synthesis and characterization of whisker crystals of iron-based superconductor. JUN LI, JIE YUAN, HUA-BING WANG, KAZU-NARI YAMAURA, Superconducting Properties Unit, National Institute for Materials Science, Tsukuba, Japan — Single-crystal superconducting whiskers of Ca$_{10}$Pt$_4$As$_8$(Fe$_{1.8}$Pt$_{0.2}$As$_2$)$_5$ were grown in a Ta capsule in an evacuated quartz tube by a flux method [J. Li, et al. J. Am. Chem. Soc. 134, 4068–4071 (2012)]. This technique can be potentially useful for growth of other whiskers containing toxic elements, although the growth mechanism is not understood well. The Ca$_{10}$Pt$_4$As$_8$(Fe$_{1.8}$Pt$_{0.2}$As$_2$)$_5$ whiskers were confirmed to have excellent crystallinity with $T_c$ of 33 K, $\mu_0 H_{c2}$ of 52.8 T, and $J_c$ of $6.0 \times 10^5$ A/cm$^2$ (at 26 K). The $T_c$ value is comparable with that of the bulk material. Since cuprate high-$T_c$ superconducting whiskers are fragile ceramics, the present intermetallic superconducting whiskers with high-$T_c$ have better opportunities for device applications. In addition, we studied the Ca$_{10}$Pt$_4$As$_8$(Fe$_{2-x}$Pt$_x$As$_2$)$_5$ superconducting whiskers consisting of several grains. With current tunneling across the grain boundaries, current-voltage characteristics show the behavior of Josephson tunnel junction effect with pronounced hysteresis. In this talk, we review the growth of the superconducting whiskers and shows progress of studies of the Josephson junction using the whiskers.

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