Superconductivity and Magnetism in isovalent substituted Europium Iron-Asenide Superconductor EuFe$_2$As$_{2-x}$P$_x$ TAKUYA ISHIKAWA, YOHEI JONO, KASUMI TASHIMA, KAZUO KADOWAKI, TAKANARI KASHIWAGI, University of Tsukuba — The EuFe$_2$As$_2$-xPx system is known as a coexisting system of superconductivity and magnetism with varying isovalent substitution concentration of P in place of As. Magnetism seems to originate from localized Eu$^{2+}$ moments around 19 K, whereas Superconductivity occurs at 28 K in $x = 0.4$. We have studied magnetic and transport properties in various single crystals grown by the self-flux method in a vertical Bridgman furnace, whose compositions are characterized by EPMA and ICP-AES. From temperature dependence of magnetic susceptibility Eu has a magnetic moment of 7.9$\mu_B$ indicating Eu$^{2+}$ obtained previously, and did not depend on $x$ upto $x = 0.3$, then coexists with superconductivity above $x = 0.4$. At the coexisting region we showed a reentrant behavior of the superconductivity in resistivity and it shows a peculiar magnetic field dependence. We show the precise phase diagram and superconductivity as a function of $x$. 

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