Enhancement of hidden order and antiferromagnetism in Fe and Os substituted URu$_2$Si$_2$ under pressure.\textsuperscript{1} CHRISTIAN WOLOWIEC, NORAVEE KANCHANAVATEE, KEVIN HUANG, SHENG RAN, M. BRIAN MAPLE, Univ of California - San Diego — We present electrical resistivity measurements made under pressure for the Fe and Os substituted URu$_2$Si$_2$. The parent compound URu$_2$Si$_2$ exhibits a hidden order (HO) phase below $T_0 = 17.5$ K at ambient pressure. A phase transition from HO to a large moment antiferromagnetic (LMAFM) phase is induced by applying pressure $P$ or by substituting Fe or Os for Ru ions. While the substitution of smaller Fe ions reduces the unit cell volume thus creating a positive chemical pressure $P_{ch}$, the substitution of larger Os ions results in a negative $P_{ch}$. As Fe concentration ($x$) is increased, the critical pressure $P_c$ forcing the HO to LMAFM phase transition is reduced from 1.4 GPa at $x = 0$ to 0 GPa at $x = 0.15$. By converting $x$ to $P_{ch}(x)$, we found that $P_{ch}(x) + P_c \approx 1.5$ GPa at the phase transition. These results suggest that $P_{ch}$ behaves like external $P$ in inducing the HO $\rightarrow$ LMAFM phase transition. However, we also found that as the Os concentration ($y$) is increased, a smaller $P_c$ is required to induce the HO $\rightarrow$ LMAFM phase transition: $P_c \sim 1.4$ GPa at $y = 0$ reduces to $P_c \sim 0$ GPa at $y = 0.065$. This is contrary to what one would expect from a negative $P_{ch}$ effect. Hence, the Os substitution study suggests that $P_{ch}$ is not solely responsible for inducing the LMAFM phase.

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