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Superconductivity in the Osmium-based Beta-Pyrochlore Oxides

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Superconductivity is reported in recently discovered βtpyrochlore oxides AOs_2O_6. The T_c is 3.3 K, 6.3 K, and 9.6 K for A = Cs, Rb, and K, respectively. The highest T_c of KOs_2O_6 is almost one order higher than the $T_c = 1.0$ K of previously reported α-pyrochlore oxide superconductor $Cd_2Re_2O_7$ which is believed to be a conventional s-wave superconductor. Moreover, the upper critical field H_{c2} of KOs_2O_6 is estimated to be 38 T, which seems to exceed Pauli's limit expected for conventional superconductivity. This is again in contrast to the case of $Cd_2Re_2O_7$, in which the H_{c2} is 0.29 T, much smaller than the corresponding Pauli's limit. These distinct contrasts strongly suggest that the mechanism of superconductivity is essentially different between the two pyrochlore oxides. It is to be noted that the T_c of these βtpyrochlore oxides decreases with increasing the ionic radius of the alkaline metal ions, imposing negative chemical pressure upon the Os pyrochlore lattice. I believe that interesting physics is involved on the basis of strong electron correlations on the highly frustrated pyrochlore lattice.