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Unconventional spin-Peierls state in the quantum magnet TiOBr[1]

J.-P. CASTELLAN, Argonne National Laboratory, J.P. CLANCY, University of Toronto, J.P.C. RUFF, Advanced Photon Source, S. ROSENKRANZ, R. OSBORN, Argonne National Laboratory, B.D. GAULIN, McMaster Univeristy, F.C. CHOU, S.H. HUANG, National Taiwan University — The discovery of spin-Peierls transitions in inorganic materials such as $CuGeO_3$ with T_{sp} of 14K allowed for the growth of large single crystals. With the availability of large single crystals the opportunity arises to introduce both magnetic and nonmagnetic impurities and study the resulting perturbations from the ground state. Recently a new class of unconventional spin-Peierls materials were discovered TiOBr and TiOCl. TiOBr and TiOCl have been shown to exhibit dimerized singlet ground states and undergo not one but two successive phase transitions. We have performed x-ray scattering measurements on single crystals of TiOBr. These measurements reveal both commensurate and incommensurate spin-Peierls phases; below T_{c2} $\sim$48K incommensurate superlattice reflections arise at Q=[H$\pm\delta$,K+1/2$\pm\epsilon$,L] which persists down to the lock in transition at $T_{c1}\sim$27K. We will report on the details of these successive transitions and the destruction of the long-range ordered spin-Peierls state with introduction of magnetic vacancies by doping with Sc.

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