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**Quantifying B Site Disorder in Polycrystalline and Single Crystal $Yb_2Ti_2O_7$ Pyrochlore by Quantitative Scanning Transmission Electron Microscopy at Atomic Resolution** ZAHRA SHAFIEIZADEH, YAN XIN, National High Magnetic Field Laboratory, Florida State University, HAIDONG ZHOU, University of Tennessee — The cubic pyrochlore oxides, $A_2B_2O_7$, have attracted much attention over the past 20 years. A and B ions reside on two distinct interpenetrating lattices of corner-sharing tetrahedral. It has been noticed that the magnetic ground states of $Yb_2Ti_2O_7$ are sample dependent. It could have long-range ordered collinear ferromagnetic state, or non-collinear ferromagnetic fluctuations, or short ranged fluctuations. In particular, the specific heat shows sharp peaks at 265 mK for polycrystalline samples, but a broad peak at 214 mK to 250 mK for optical floating zone (OFZ) single crystals. Neutron scattering study shows that OFZ single crystals are lightly stuffed pyrochlore with 2.3% Yb on to Ti sites. We have studied this disorder by quantitative scanning electron microscopy at atomic resolution for both polycrystals and single crystals. We have carried out atomic resolution imaging of $Yb_2Ti_2O_7$ along [110] and by comparing image simulations, we have quantified the Yb atoms on the Ti atomic columns, and compared the disorders for both crystals. We also related the degree of the disorder to their magnetic ground states.

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