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Impurities in Spin Ice Crystals GABRIELE SALA, TCM group, Royal Holloway University of London and ISIS Facility, CLAUDIO CASTELNOVO, TCM group, Cavendish Laboratory, University of Cambridge, JON GOFF, Royal Holloway University of London, MATTHIAS GUTMANN, Rutherford Appleton Laboratory (ISIS Facility), PRABHAKARAN DHARMALINGAM, CM group, Claredon Laboratory, University of Oxford — Spin ice crystals (and pyrochlore oxides in general) have raised a lot of interest of late thanks to their exotic properties, including emergent gauge symmetries, possible spin liquid behavior, and magnetic monopole excitations. Theoretical and experimental efforts in the study of these materials have benefited from the relative ease of growth of large clean single crystals. Even in such clean systems, however, impurities can play a crucial role in determining the properties at very low temperatures (see e.g., C. Henley, http://arxiv.org/abs/1210.8137). Here we investigate this issue both experimentally and theoretically. We study how controlled non-magnetic Y-dilution in $Dy_2Ti_2O_7$ gradually alters the effective monopole description and the thermodynamic properties of the system at low temperature (extending earlier work by other authors to regimes that have not been investigated so far). We also study how oxygen deficiency affects spin ice samples, and we discuss how the oxygen stoichiometry can be quantified and controlled experimentally.

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