High-resolution powder diffraction as a probe for cooperative electronic phenomena in advanced materials

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With the advent of synchrotron light sources, the scope of the powder diffraction technique has experienced great advances, becoming an increasingly powerful tool for detailed in-situ or ex-situ studies of physical and/or chemical processes in advanced materials. Particularly, the high angular resolution makes it possible to investigate subtle structural changes as a function of a given thermodynamical variable, caused by electronic effects that may couple with the crystal lattice. Some recent examples will be discussed, including an orbital ordering transition driven by spin-orbit coupling in the double perovskite Ba_2FeReO_6 and the identification of subtle, though important, structural anomalies in the multiferroic system $R Mn_2O_5$ (R = Y, Bi, rare earth).