Flash Sintering of Bismuth Ferrite in situ with EDXRD

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Bismuth ferrite is a multiferroic material that has unique properties at the nanoscale level at room temperature. It is subject to large leakage currents and low electrical resistivity, and one way to overcome that is with dopants such as lanthanum. Applications for bismuth ferrite include ferroelectric memory devices and a potential piezoelectric replacement for lead-based materials like PZT. Bismuth ferrite has a Curie temperature of 825 °C (1098 K), making it difficult to sinter using typical methods while still retaining its multiferroic properties. Recently, bismuth ferrite has been spark plasma sintered, so it is of great interest to reduce the sintering time even further through flash sintering, a relatively new manufacturing technique that saves time and energy compared to other sintering methods.

Through a collaboration with the Institute for the Science of Materials in Seville, Spain work has been done on the flash sintering of bismuth ferrite to understand how these materials are flash sintered in-situ using energy dispersive X-ray diffraction (EDXRD) at the Advanced Photon Source at Argonne National Laboratory. We obtained bismuth ferrite that Pérez-Maqueda's lab prepared via direct mechanosynthesis. We were able to flash sinter bismuth ferrite at temperatures as low as 350°C, significantly below the Curie temperature, which enabled the material to retain its multiferroic properties.