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Abstract

We report the characteristic influence of applied-voltage on the fabrication of one-dimensional fiber nanostructures of bismuth ferrite ($BiFeO_3$/BFO) in electrospinning process. The applied voltage of 8 kV is found to be the threshold voltage for the formation of BFO fibers. The further systematic variation of voltages such as 10 kV, 15 kV and 20 kV yielded smaller broken-fibers that appeared to be rod-like nanostructures, lengthy-ordered fibers, and belt-like nanostructures respectively. The crystal phase analysis by X-ray diffraction technique revealed the rhombohedral perovskite structure of BFO. The average diameter/thickness of rods, fibers and belts is estimated from their FESEM and HRTEM images and it found to be 90-150 nm, 100-200 nm and 100-150 nm respectively. The optical and magnetic studies by UV-visible spectrometer and SQUID magnetometer respectively revealed the dimension dependent optical properties, where their magnetic properties are found to be in the order of belts > rods > fibers > aggregated fibers. The formation of fibers is initiated with the evolution of electrified jet; where the variation in the applied voltage causes bending and whipping instability in the electrified jet that presumably determined the morphological and compositional structures of fibers.