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Structural evolution from $Bi_{4.2}K_{0.8}Fe_2O_{9+\delta}$ nanobelts to $BiFeO_3$ nanochains and their multiferroic properties SINING DONG, Univ of Notre Dame, XIAOGUANG LI, Univ of Sci and Tech of China, XINYU LIU, MALGORZATA DOBROWOLSKA, JACEK FURDYNA, Univ of Notre Dame — In this study, we reported the structural evolution of $Bi_{4.2}K_{0.8}Fe_2O_{9+\delta}$ nanobelts to $BiFeO_3$ nanochains and the related variations of multiferroic properties. By using in-situ transmission electron microscopy with comprehensive characterization, it was found that the layered perovskite multiferroic $Bi_{4.2}K_{0.8}Fe_2O_{9+\delta}$ nanobelts were very unstable in a vacuum environment with Bi being easily removed. Based on this finding, a simple vacuum annealing method was designed which successfully transformed the $Bi_{4.2}K_{0.8}Fe_2O_{9+\delta}$ nanobelts into one-dimensional $BiFeO_3$ nanochains. Both the $Bi_{4.2}K_{0.8}Fe_2O_{9+\delta}$ nanobelts and the $BiFeO_3$ nanochains showed multiferroic behaviors, with their ferroelectric and ferromagnetic properties clearly established by piezoresponse and magnetic measurements, respectively. Interestingly, the $BiFeO_3$ nanochains exhibited a surprisingly large exchange bias with small training effects. This one-dimensional $BiFeO_3$ multiferroic nanostructure characterized by a relatively stable exchange bias offers important functionalities that may be attractive for device applications.

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