# Structural Properties of Nanostructured Multiferroic Composite

Multiferroics refer to multifunctional materials having two or more ferro-orders, such as: ferroelectric, ferromagnetic and/or ferroelastic [1,2]. Obtaining strong coupling between them is a relevant and important task [3,4]. One of the promising methods for enhancing coupling is the use of high-pressure torsion (HPT).

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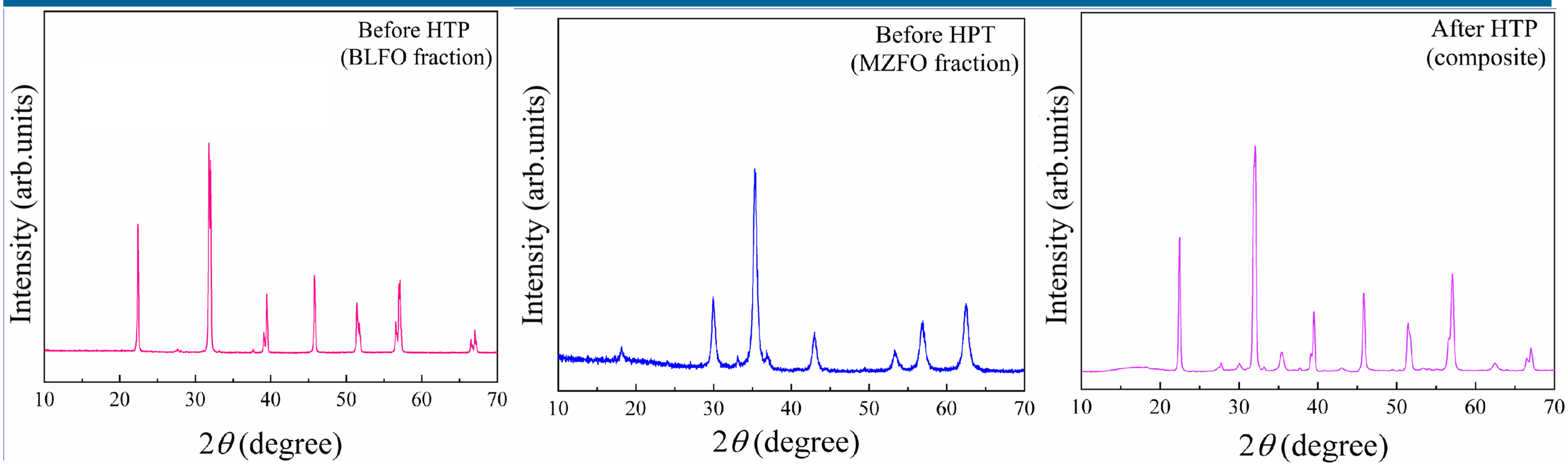
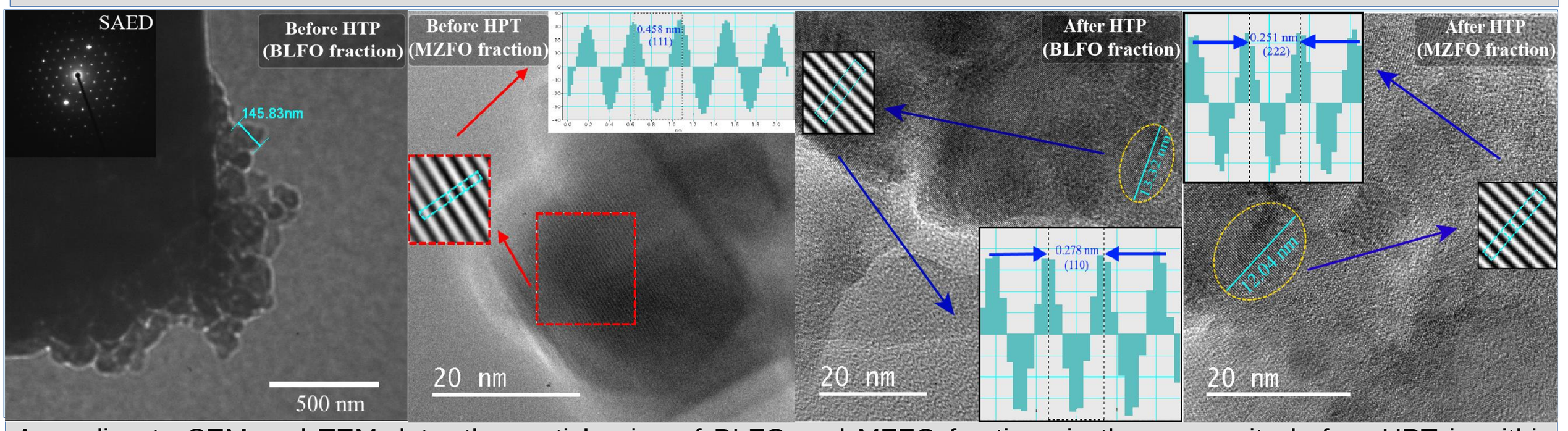
## Methods of Investigation

- X-ray diffraction (XRD) method using Shimadzu LabX XRD-6000 diffractometer in $Cu_{K\alpha 1}$-radiation (λ = 0.15418 nm) at room temperature
- Transition electron microscopy (TEM) method using JEM-2200FS Transmission Electron Microscope
- Scanning electron microscopy (SEM) and Energy Dispersive Spectroscopy (EDS) methods using FEI Magellan 400 Scanning Electron Microscope

## Results and Discussion




The new type-II multiferroic 0.8Bi0.9La0.1FeO3 (BLFO) − 0.2Mn0.6Zn0.3Fe2.1O4 (MZFO) nanostructured composite was studied before and after HPT under *P* = 5 GPa (5 times torsion). According to XRD, it was found that the initial composite consisting of rhombohedral *R*3*c* and cubic *Fd*3*m* phases retains their phases after HPT.




According to SEM and TEM data, the particle size of BLFO and MZFO fractions in the composite before HPT is within 130−370 nm and 12−15 nm, respectively. After HPT, the particle size of BLFO and MZFO fractions is reduced significantly, especially for BLFO phase in 10 times up to ~ 15 nm. Chemical composition of the composite was confirmed by EDS and corresponded stoichiometric one.

## Conclusions

- Multiferroic BLFO demonstrates rhombohedral polar *R*3*c* perovskite structure with an average particle size of 160 nm.
- Ferromagnetic MZFO exhibits cubic *Fd*3*m* spinel structure with an average particle size of 12 nm.
- The 0.8BLFO-0.2MZFO nanocomposite combining multiferroic BLFO and ferromagnetic MZFO phases retains their structures after HPT, but significantly decreases size of BLFO component.

## References

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