Raman investigation of multiferroic $BiFeO_3$ and $Bi_{1-x}Sm_XFeO_3$ materials synthesized by the sol-gel method

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The main stages of sol-gel process

Stoichiometry calculation $Bi(NO_3)_3$, $Fe(NO_3)_3$ and $C_6H_8O_7$

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Heating of Bi-Fe-O powder at 180°C for 2 hours

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Sintering process at 550°C for 10 hours respectively and additionally 600, 700 °C for 3 hours respectively

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Thermo-treatmen in air

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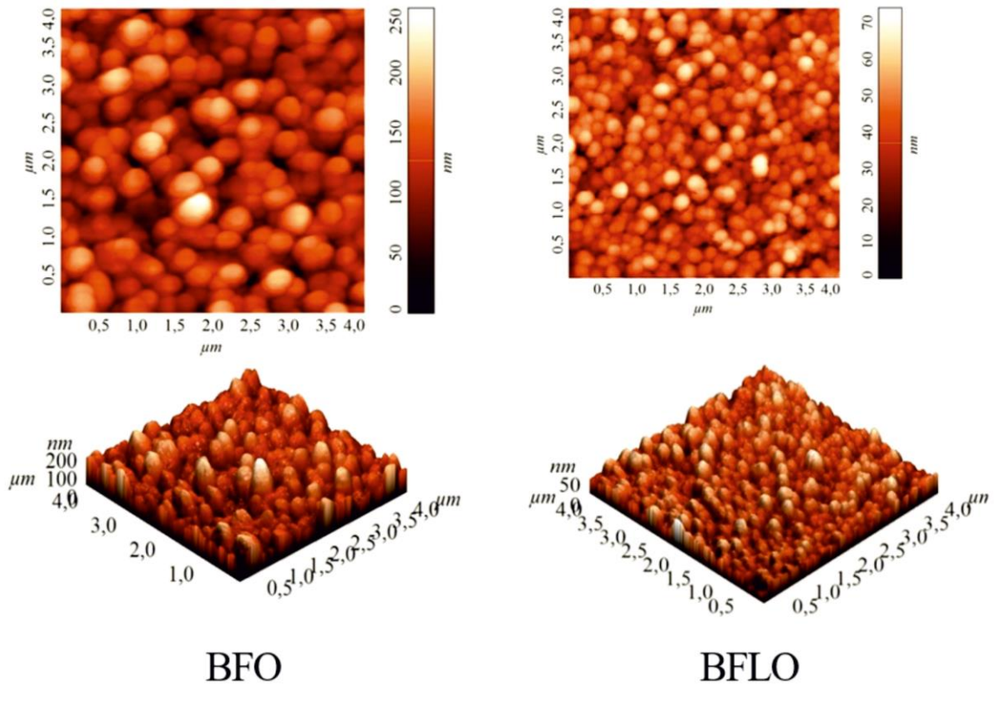
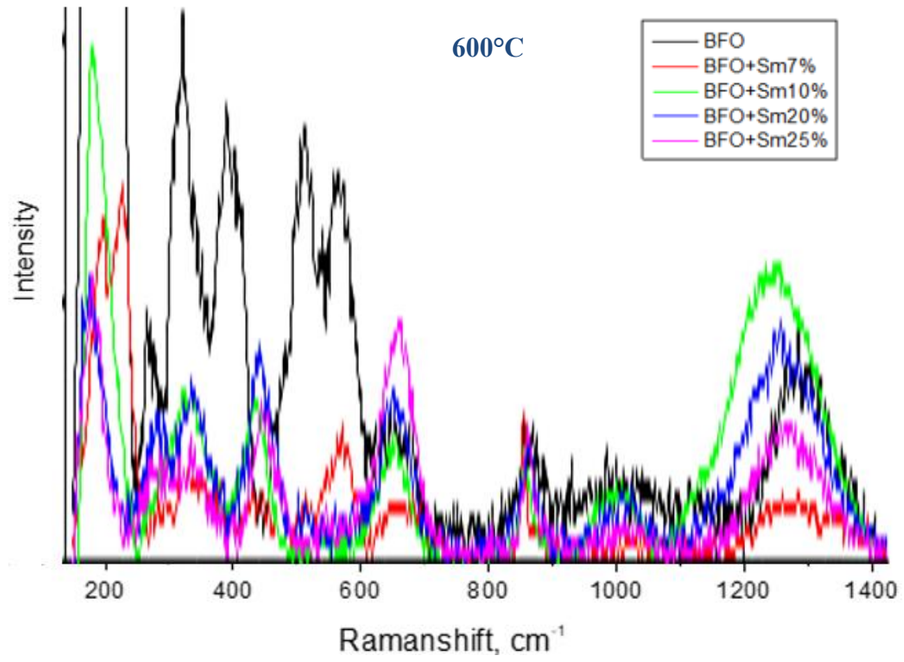
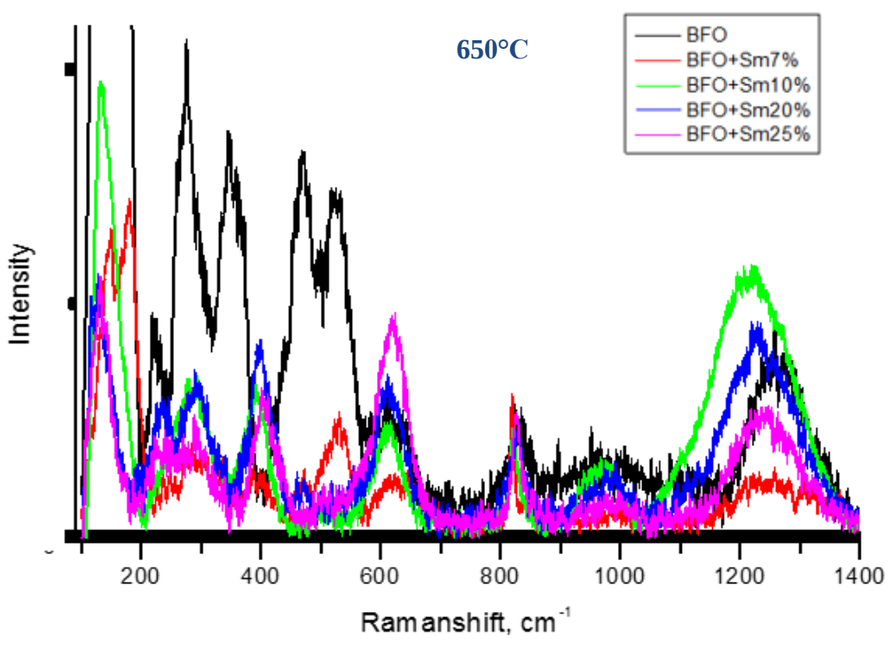
$BiFeO_3$ powder



AFM image of $BiFeO_3$ (left) and $Bi_{0.9}La_{0.1}FeO_3$ (right) powders hours



Raman spectra of BFO with different concentration of Sm (600°C)



Raman spectra of BFO with different concentration of Sm (650°C)

The position of Raman modes for the samples

Raman mode (cm^{-1})	BFO	BFO+Sm7%	600°C BFO +Sm10%	BFO +Sm20%	BFO +Sm25%	BFO	BFO+Sm7%	650°C BFO+Sm10%	BFO+Sm20%	BFO +Sm25%
A1-1	140	148	133	130	133	139	147	137	132	130
A1-2	171	179	-	-	-	170	180	181	-	-
A1-3	220	230	-	-	-	225	236	240	238	235
E	276	290	291	290	289	276	281	288	295	296
A1-4	346	399	394	398	402	344	400	401	404	403
E	470	472	-	-	-	469	478	474	-	-
E	525	530	-	-	-	524	530	527	-	-
E	614	615	616	617	619	612	613	611	612	613

Multiferroic materials ($BiFeO_3$ and $Bi_{1-x}Sm_XFeO_3$) with perovskite structure (600°C and 650°C annealing temperature) with different Sm content from 7% to 25% were synthesized by sol-gel method and were investigated by Raman spectroscopy. It was established that with increasing number of doping atoms A1-1 and A1-2 modes almost merge together demonstrating the existence of the tetragonal phase with higher crystal symmetry.

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