High-temperature Magnetodielectric $Bi(Fe_{0.5}Mn_{0.5})O_3$ Thin Films with Checkerboard-Ordered Oxygen Vacancies and Low Magnetic Damping

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The possibility of affecting the magnetic properties of a material by dielectric means, and vice versa, remains an attractive perspective for modern electronics and spintronics. Here, we report on epitaxial $Bi(Fe_{0.5}Mn_{0.5})O_3$ hin films with exceptionally low Gilbert damping and magnetoelectric coupling above room temperature (<400 K). The ferromagnetic order, not observed in bulk, has been detected with a total magnetization of 0.44 μ_B/formula units with low Gilbert damping parameter (0.0034), both at room temperature. Additionally, a previously overlooked check-board ordering of oxygen vacancies is observed, providing insights on the magnetic and dielectric origin of the multifunctional properties of the films. Finally, intrinsic magnetodielectric behavior is observed as revealed by the variation of dielectric permittivity well above room temperature. These findings show the possibility of electric-field-controlled magnetic properties, in low Gilbert-damping-based spintronic devices, using single-phase multiferroic materials.[1]

References:

[1] E. Coy, et al. Phys. Rev. Applied 10, 054072 (2018)

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