Oxides, oxides, and more oxides: High-oxides, ferroelectrics, ferromagnetics, and multiferroics

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Abstract: We review and critique the recent developments on multifunctional oxide materials, which are gaining a good deal of interest. Recongnizing that this is a vast area, the focus of this treatment is mainly on high-dielectric, ferroelectric, magnetic, and multiferroic materials. Also, we consider ferrimagnetic oxides in the context of the new, rapidly developing field of negative-index metamaterials. This review is motivated by the recent resurgence of interest in complex oxides owing to their coupling of electrical, magnetic, thermal, mechanical, and optical properties, which make them suitable for a wide variety of applications, including heat, motion, electric, and magnetic sensors; tunable and compact microwave passive components; surface acoustic wave devices; nonlinear optics; and nonvolatile memory, and pave the way for designing multifunctional devices and unique applications in spintronics and negative refraction-index media. For most of the materials treated here, structural and physical properties, preparation methods accompanied by particulars of synthesis of thin films, devices based on them, and some projections into their future applications are discussed.

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