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Tunable Ferromagnetic Nanomaterials for 6G Technology: Fundamentals and Prospects

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Modern subterahertz-terahertz (subTHz-THz) technologies, including 5G and 6G wireless telecommunication and THz optoelectronics, apply for working frequency range of tens of gigahertz to several terahertz (millimeter-submillimeter wavelengths). Demanded flexibility of various application calls for thorough investigation of materials with tunable functional characteristics. Understanding the physical mechanisms responsible for tunability of the specific parameters of materials paves the way for targeted controlling their properties and, in turn, allows to choose the material with desired parameters for the particular (and/or even multiple) applications when designing specific devices. Here, we discuss the influence of the variation of the form of material (nanoceramics, powders, single crystals) as well as of the grain sizes, and preparation conditions, on the dielectric and magnetic characteristics of the ferromagnetic hexaferrites and epsilon iron oxide that are among most perspective materials to be used for fabrication of elements and devices of future optoelectronics. The prospects of their potential applications are discussed in detail.