Abstracts

Do we really need ferroelectrics in paraelectric phase only in electrically controlled microwave devices?

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Typical paraelectric materials (e.g., SrTiO/sub 3/, KTaO/sub 3/, Ba/sub x/Sr/sub 1-x/TiO/sub 3/, x<0.5) and electrically tunable microwave devices based on these materials are briefly reviewed. The analysis shows that in spite of the recent year's extensive efforts, no considerable improvement in the microwave losses in thin paraelectric films has been achieved. Thin films, regardless of fabrication method and substrate type, have much lower dielectric permittivity than bulk single crystals, and the loss tangent at microwave frequencies (f>10 GHz) is of the order of 0.01 (at zero dc-bias field) at room temperature. Nevertheless, quite promising component and subsystem level devices are successfully demonstrated. Use of ceramic (bulk and thick film) ferroelectrics in tunable microwave devices, currently considered for industrial applications, offer cost reduction. In this paper, explicitly for the first time, we consider possibilities and benefits of using ferroelectrics in polar phase in electrically controllable microwave devices. Examples of using ferroelectrics in polar state (e.g., Na/sub 0.5/K/sub 0.5/NbO/sub 3/, SrTiO/sub 3/ in antiferroelectric phase) in electrically tunable devices are reported.

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