Symmetry Analysis of spontaneously polarized and/or magnetized non-ferroelastic Domain Walls

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A planar domain wall is a thin transient region connecting two domains. It can be considered as a layer (with two-dimensional translation symmetry). The symmetry of such objects is described by layer groups.

Comparing the symmetry of the domain wall with the symmetry of adjacent domains it is possible to predict in which tensor properties the domain wall differs from the properties of domains. This approach was applied to examination of appearance of the spontaneous polarization **P** and/or magnetization **M** in magnetoelectric materials.

The global symmetry of the wall controls (completely or partially) the orientation of **P** and **M** in the wall (except the trivial symmetry 1, 1', -1), their relative position and their orientation with respect to the normal of a domain wall. The local symmetries within the domain wall qualify possible changes of orientation (behavior) of **P** and **M** within the domain. It is illustrated on examples of some magnetoelectric materials (e.g. Cr_2O_3). We also present a brief summary of a systematic analysis of possible appearance of spontaneous polarization and/or magnetization in non-ferroelastic domain walls.