Morphotropic phase boundaries in ferromagnets: Tb\(_{1-x}\)Dy\(_x\)Fe\(_2\) alloys

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The structure and properties of the ferromagnet Tb\(_{1-x}\)Dy\(_x\)Fe\(_2\) are explored through the morphotropic phase boundary (MPB) separating ferroic phases of differing symmetry. Our synchrotron data support a first order structural transition, with a broadening MPB width at higher temperatures. The optimal point for magnetomechanical applications is not centered on the MPB but lies on the rhombohedral side, where the high striction of the rhombohedral majority phase combines with the softened anisotropy of the MPB. We compare our findings with single ion crystal field theory and with ferroelectric MPBs, where the controlling energies are different.

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