Towards the computational design of soft magneto-electric composites

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ABSTRACT

Materials that couple electric and magnetic fields are employed, e.g., as magnetic field sensors and random access memory components. Because of the very low coupling properties of single phase materials, the use of magneto-electric composites has been suggested [1]. More recently, Liu and Sharma [2] investigated magneto-mechanical and electro-mechanical coupling properties of *soft* composites forming a new class of magneto-electro-mechanically coupling materials. This innovative class of composites has as main advantages the relative low cost of the single phases, the straight-forward manufacturing process and their fracture toughness. While there exist numerical studies on *hard* magneto-electric composites [3], we are not aware of any numerical studies on *soft-matrix* magneto-electric composites with focus on their magneto-electric coupling properties in literature. Such studies would provide important insight for the design of competitive magneto-electric devices. Therfore, within this contribution, we present multiscale simulations of soft magneto-electric bodies [4] under physically reasonable, experimentally motivated boundary conditions [5]. By this we investigate, on the one hand, the effective reponse of the composite and, on the other hand, the influence of the macroscopic shape [6] on the overall coupling properties of magneto-electric devices.

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