

EFFECTIVE PROPERTIES OF MAGNETOELECTROELASTIC MATERIALS WITH ALIGNED ELLIPSOIDAL VOIDS

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ABSTRACT

Materials with magnetoelastoelectric coupling effect have attracted much attention from many investigators in the past decade due to their potential applications in engineering [1]. Achieving the coupling effect as strong as possible is one of the main twists for research efforts. Presence of defects may influence the behavior of magnetoelastoelectric materials. The present work considers the influence of aligned ellipsoidal voids on the effective properties of magnetoelastoelectric composites (Fig.1). Treating the voided composite as composed of matrix, inclusions and second inclusions, the effective properties can be obtained based on the Eshelby's equivalent inclusion principle. Effects of both the density and the orientation of the voids are specifically studied.

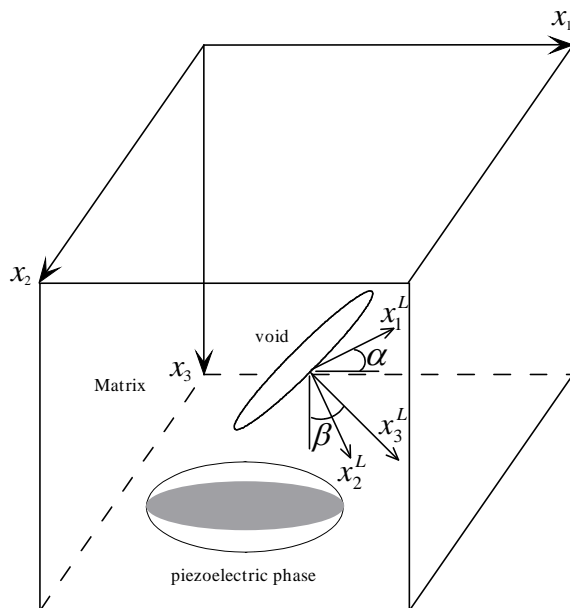


Figure 1 schematic illustration of the RVE

Some typical numerical results are shown in Figs. 2 and 3. It can be seen that due to the degradation of the mechanical interaction between the constituents by the presence of defects like voids, the magnetoelectric coupling coefficients of the composites are deteriorated, which may explain partly the overestimation of some effective properties of magneto-electroelastic composites based on the void free predictions. The orientation or alternatively the shape of the voids can also influence the effective properties and in certain range of orientations, they exhibit certain maximum values for fixed void density.

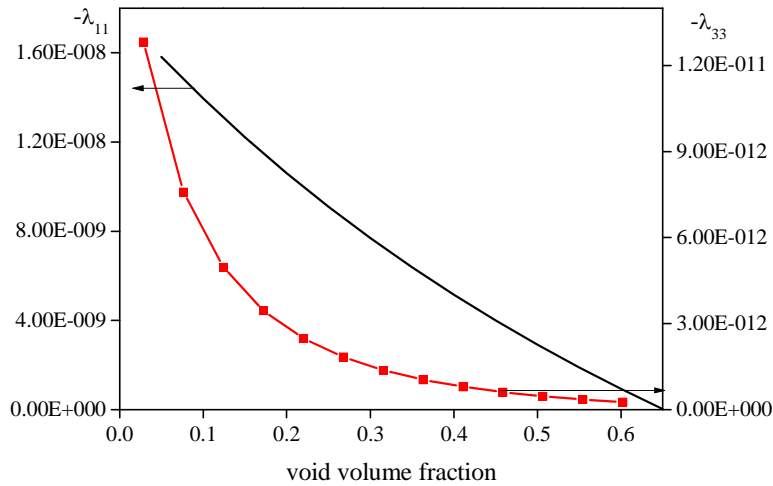


Fig. 2. Effective magnetoelectric coefficients as a function of void volume fraction

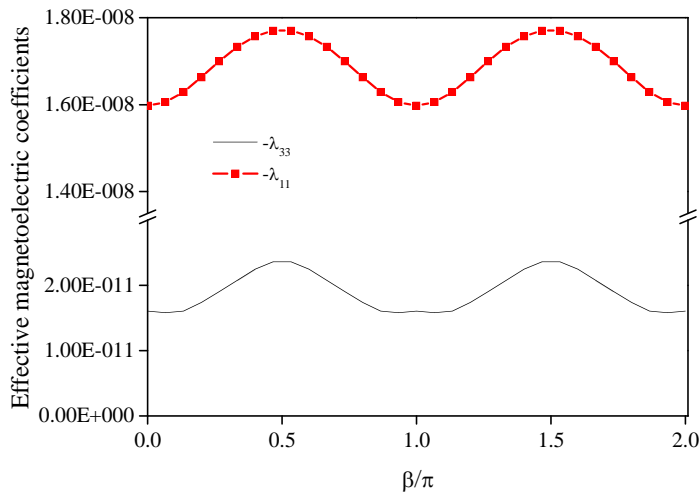


Fig. 3. Effect of orientation of the void on effective magnetoelectric coefficients

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- [1] Manfred Fiebig, "Revival of the magnetoelectric effect", *J. Phys. D: Appl. Phys.* Vol.38, pp.R123-R152, (2005).