

Electromagnetic fields in the solid material neighbouring porous media

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Numerous studies reported that there are electromagnetic(EM) wave-fields associated with seismic waves. The electrokinetic effect, as one of the most possible mechanisms resulting in the coupling between the seismic and EM wave-fields, has attracted wide attention in the area of seismoelectromagnetism. The numerical experiments have confirmed that a finite fault in porous media can induce seismoelectromagnetic signals. The characteristics and the magnitude of amplitudes are consistent with those observed in natural earthquakes. However, all the used models consist of porous materials. In this work, we carried out numerical experiments to investigate the situation in the layered model composed of solid and porous materials together. It is found there are two kinds of EM waves in the solid material, the homogeneous and inhomogeneous EM waves. The former one is generated by the direct EM waves radiated from the source or the normal incident seismic waves at the interface between the solid and the porous media. The latter one is generated by the oblique incident seismic waves whose horizontal wavenumber is greater than the EM wavenumber in the solid media. The inhomogeneous EM waves propagate in the horizontal direction and decrease when the distance to the interface increases. For the solid area which is close to the interface (e.g., within 200m), the inhomogeneous EM waves behave very similar with the co-seismic EM signals in the pure-porous model.

Keywords: electrokinetic effect, the coupled seismic and electromagnetic fields, solid material neighbouring porous media, converted electromagnetic waves generated at the interface