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SH-TE acoustoelectric waves in double-cylindrical porous formation

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Due to the existence of electric double layer in fluid-saturated porous media, Acoustoelectric effect will occurred when acoustic waves propagate through media. In the logging while drilling environment the drilling collar might be taken as a shear source. SH-TE acoustoelectric logging is a potential method to obtaining shear wave velocity directed in LWD environments. When the interface exist out of the borehole, is it possible to use SH-TE acoustoelectric logging to estimate the interface? In order to simply our question, we consider the double-cylindrical formation model. We introduced the potential functions of SH-TE seismoelectric waves in porous formation. The expression of acoustic and electric/magnetic fields are obtained based on Pride theory and potential functions. With the boundary conditons at fluid /inner-porous cylinder and the boundary conditions at inner/outer porous formation, the coefficients of the potential will determined. With the field equations, we calculated the transient waveforms of the electric or magnetic fields at any point along the borehole, and obtain the displacement of acoustic on the wall by digital Fourier transform. It is shown that there are five wave packets in the waveform of electric field. Two packets which reach simultaneously at recorders are generated at inner interface and outer interface. When the outer formation is homogenous, only one EM and SH wave packets will appear. The last two Love modes appear when the outer interface exists. One can obtain the acoustic velocity of SH wave and estimate the position of outer interface. It is a potential new method to detect the interface out the borehole using SH-TE acoustoelectric waves.

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