Modeling on Frequency Dependent Attenuation – Effects of Viscosity

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Abstract

Attenuation and dispersion in viscoelastic rock samples are always interesting to geophysicists. Depending on the physical properties of the rocks (saturation, porosity, permeability and viscosity), attenuation and dispersion could be quite different, especially in different frequency ranges. This paper provides an overview of theoretical aspects (rheology and viscoelasticity) of attenuation mainly due to viscosity and may have implication for heavy oil reservoir.

Rheological models have been reviewed to model attenuation in a variety of frequencies. Properties of rock samples can be obtained by measuring its dynamic response to an oscillating load. Here, general constitutive relation and Kronig-Kramers relation are assumed. As a result, viscosity and shear modulus can be determined. Thus, quality factor and attenuation coefficient can be calculated. In this study, viscosity has been counted for the major factor of attenuation.

Due to the geological complexity of the sample, empirical relations may be taken into consideration other than rheological models in lab measurements. Further study could be on the effects of temperature as well as pressure.