地球物理学报 » 2009, Vol. 52 » Issue (12) :3051-3060 doi:10.3969/j.issn.0001-5733.2009.12.014
地球动力学★地震学★地磁学



引用本文(Citation):
杜赟;席道瑛;徐松林;易良坤.多孔岩石波传播的热弛豫模型修正. 地球物理学报, 2009,52(12): 3051-3060,doi: 10.3969/j.issn.0001-5733.2009.12.014

DU Yun;XI Dao-Ying;XU Song-Lin;YI Liang-Kun.The modification of thermal relaxation mechanism for wave propagation in porous rocks.Chinese J.Geophys. (in Chinese),2009,52(12): 3051-3060,doi: 10.3969/j.issn.0001-5733.2009.12.014

# 多孔岩石波传播的热弛豫模型修正

杜赟[1];席道瑛[1];徐松林[2];易良坤[3]*

1 中国科学技术大学 地球和空间科学学院， 合肥 230026
2 中国科学技术大学 中国科学院材料力学行为与设计重点实验室，合肥 230027
3 中国石油集团 东方地球物理公司研究院，河北涿州 072750

# The modification of thermal relaxation mechanism for wave propagation in porous rocks

DU Yun[1];XI Dao-Ying[1];XU Song-Lin[2];YI Liang-Kun[3]*

1 School of Earth and Space Science, University of Science and Technology of China, Hefei 230026, China
2 CAS Key Laboratory for Mechanical Behavior and Design of Materials, University of Science and Technology of China, Hefei 230027, China
3 Geophysical Research Institute, Bureau of Geophysical Prospecting, Zhuozhou Hebei 072750, China

摘要 | 参考文献 | 相关文章

Download: PDF (2775KB) HTML 0KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要 经研究发现热弛豫模型的衰减比BISQ模型大得较多，与地球介质相比衰减量也过大；反演与实验结果相比在虚模量的低频(或低温)端和高频(或高温)端相差较大，仅在峰值附近符合较好.针对上述不足，将Arrhenius关系直接引进Biot模型，替换原模型引进的峰值点的频率对数和温度关系，并重新调整了模型参数.这样既改善了原模型衰减量过大，又克服了模型反演中虚模量峰值曲线两侧差异较大的缺点.进行了P波和S波的波传播分析，仍然在频率谱和温度谱上获得热弛豫峰和Biot峰.分析显示热弛豫峰导致波速随频率升高而上升的普遍规律，Biot峰导致波速随温度升高而上升的异常现象.在相同条件下对Biot模型，BISQ模型和热弛豫模型的P波波速和衰减进行了对比.热弛豫模型得到的速度频散更强，频散范围更宽，所得的衰减峰值频率比BISQ模型要低，衰减幅度比BISQ模型稍大.这些结果与实验结果相近，更符合实际.

关键词 多孔岩石， 热弛豫， 速度频散， 衰减

Abstract: The attenuation of thermal relaxation model is much higher than BISQ model, and also higher than the attenuation of earth medium. The inversion results of imaginary modulus in low frequency (or low temperature) area and high frequency (or high temperature) area are not pleasantly satisfied with the experimental results. The inversion results coincide with the experimental results only at the nearby area of attenuation peak. The original Arrhenius relation is introduced into Biot model to substitute the used frequency-temperature relationship at attenuation peak, and some changes of the parameters have been made. Then the results of the modified model eliminate the high attenuation and the mismatch of inversion results and experimental results of imaginary modulus in the old model. 1-D P-wave and S-wave propagation characteristics are analyzed. Thermal relaxation attenuation (TA) peak and the Biot attenuation peak are obtained on both frequency and temperature spectra. Overall analysis show that the appearance of TA peak leads to a universal law, the velocity increases with the frequency. The existence of Biot peak leads to an unusual phenomenon, the velocity increases with the temperature. Comparison is made for Biot, BISQ, and thermal relaxation model. Larger dispersion and wider dispersion range are observed in thermal relaxation model. The attenuation peak frequency of thermal relaxation model is lower than that of BISQ model, and the attenuation is a little larger. These numeric results are close to experimental results, which is more realistic.

Keywords Porous rock, Thermal relaxation, Velocity dispersion, Attenuation

Service
把本文推荐给朋友
加入我的书架
加入引用管理器
Email Alert
RSS
作者相关文章
杜赟
席道瑛
徐松林
易良坤