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脉冲中子双伽马谱饱和度测井方法及数值模拟研究

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Study on the dual gamma spectrum saturation logging method based on pulsed neutron source and numerical simulation

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摘要

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摘要 脉冲中子双伽马谱饱和度测井方法是利用特定的脉冲和测量时序设计,采用远、近伽马探测器记录非弹性散射和俘获伽马能谱以及伽马射线时间谱,通过获取C/O和地层宏观俘获截面等信息来确定地层含油饱和度.采用大直径仪器和BGO晶体探测器时,其采集的非弹性散射和俘获伽马能谱计数统计性优于国外仪器,重复脉冲发射中子后伽马射线时间谱仍满足指数衰减规律,且能使伽马射线时间谱的道计数累积,计数统计性好于常规中子寿命测井,得到的地层宏观俘获截面与单脉冲发射近似相同.在地层孔隙度未知的情况下,利用C/O和地层宏观俘获截面交会技术可以定量确定含油饱和度.

关键词: 脉冲中子 双伽马谱 C/O 地层宏观俘获截面 蒙特卡罗模拟

Abstract: The dual gamma spectrum saturation logging based on pulsed neutron source is a new technology that can at the same time record inelastic scattering and capture gamma ray spectra, along with gamma ray time spectrum at the far and near gamma ray detector by means of a special pulse and measurement timing design. It is found that counting statistics of inelastic scattering and capture gamma ray is superior to foreign instruments by using large-diameter instrument and BGO crystal detector. The gamma ray time spectrum after repeated pulse neutron emission still meets the exponential decay law, and the channel count of gamma ray time spectrum is cumulated, so its counting statistics is better than conventional neutron lifetime logging. In addition, the macroscopic absorption cross section obtained by this pulse and measure timing is nearly the same as the single pulse. It is found that the oil saturation can be determined with the cross-plot technology of C/O and formation macroscopic absorption cross section under the condition of unknown formation porosity.

Keywords: Pulsed neutron Dual gamma spectrum C/O Formation macroscopic absorption cross section Monte Carlo simulation

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