

## 声波测井相控圆弧阵及其辐射指向性

乔文孝<sup>1,2</sup>, 车小花<sup>1,2</sup>, 鞠晓东<sup>1,2</sup>, 陈雪莲<sup>3</sup>

1 中国石油大学(北京)资源与信息学院, 北京 102249; 2 油气资源与探测国家重点实验室(中国石油大学, 北京), 北京 102249; 3 中国石油大学(华东)地球资源与信息学院, 山东东营 257061

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**摘要** 为了实现声波测井的周向分辨能力, 提出了可应用于声波测井的、具有周向辐射指向性的相控圆弧阵声波辐射器方案. 声波测井圆弧阵发射换能器由多个压电振子沿着圆周排列, 通过控制各个振子的激励时间可以实现向某个方位方向的声波辐射. 本文以自制的28阵元相控圆弧阵为例, 理论和实验研究了相控圆弧阵的辐射指向性及其与阵元个数、声波频率等参数之间的关系. 研究表明, 在声波测井频率范围内, 随着工作阵元个数和频率的增加, 圆弧阵辐射声波的周向指向性增强, 理论研究和实验研究取得了相一致的结果. 与现有的声波测井单极子、偶极子和四极子声源相比, 在井下采用相控圆弧阵作为声波辐射器可以真正实现方位声波测井, 在各向异性地层评价、定向钻井和井间地层评价等石油工程中有良好的应用前景.

**关键词** [圆弧阵](#) [声波测井](#) [指向性](#) [方位](#)

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## Acoustic logging phased arc array and its radiation directivity

QIAO Wen-Xiao<sup>1, 2</sup>, CHE Xiao-Hua<sup>1, 2</sup>, JU Xiao-Dong<sup>1, 2</sup>, CHEN Xue-Lian<sup>3</sup>

1 Faculty of Natural Resources & Information Technology, University of Petroleum, Beijing 102249, China; 2 State Key Laboratory of Petroleum Resource and Prospecting (China University of Petroleum, Beijing), Beijing 102249, China; 3 Faculty of Geo-Resource & Information, China University of Petroleum, Shandong Dongying 257061, China

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**Abstract** A kind of acoustic phased arc array with circumferentially controlled directivity presented in this paper can be used to make acoustic logging with circumferential azimuth detection function. The arc array transmitter is composed of many ceramic flexural vibrators which are arranged in an annulus. Directional radiation is realized by controlling the vibrating phase of each vibrator. The radiation directivity and its relation with the parameters of a self-made 28-element phased arc array, such as the number of active element and frequency, are investigated by numerical simulation and experimental measurement. The results of numerical simulation and experimental measurement have good agreement. The directivity of the arc array becomes better with the increasing of the number of active element and acoustic frequency. Unlike monopole, dipole and quadrupole transmitters presently used in acoustic logging, the acoustic phased arc array, which will be used downhole in the future, is the key to realize acoustic logging with circumferential azimuth detection function and has a good application prospect in the petroleum industry for anisotropy evaluation, directional drilling and crosswell formation evaluation and so on.

**Key words** [Arc array](#) [Acoustic logging](#) [Directivity](#) [Circumferential azimuth](#)

通讯作者:

乔文孝 [qiaowx@vip.163.com](mailto:qiaowx@vip.163.com)

作者个人主页: 乔文孝<sup>1,2</sup>; 车小花<sup>1,2</sup>; 鞠晓东<sup>1,2</sup>; 陈雪莲<sup>3</sup>

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