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电磁场作用下球形磁极辅助研磨弯管内表面研究

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摘要: 弯管弯曲成形后,在弯折处易产生微裂纹、褶皱等表面质量缺陷问题。本文通过采用六自由度机械手拖动电磁场发生装置沿加工轨迹往复运动,电磁场发生装置驱动球形辅助磁极绕管件内壁转动,实现了对弯管内表面的光整加工。在此基础上,通过对弯管轮廓采集及曲线拟合,重新构建了弯管中心线并转换为新的研磨加工轨迹。采用超景深3D电子显微镜和触针式表面粗糙度测量仪对研磨试验前后弯管内表面的形貌和粗糙度进行了对比分析。结果表明,通过重新构建研磨加工轨迹,试验装置有效解决了研磨弯折处的干涉与研磨不均匀等问题。研磨55 min后,表面粗糙度由原始的0.713 μm降低到0.194 μm,铜合金弯管内表面原始质量缺陷基本去除,表面纹理较为致密均匀。该方法有效避免了未规划研磨轨迹时出现的犁耕等纹理缺陷,提高了弯管的服役可靠性。

关键词: 弯管;电磁场;磁粒研磨;轨迹构建;研磨效率;表面形貌
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Study on the Inner Surface Finishing of Bend Pipe by Electromagnetic Fields Drive Spherical Magnetic Pole

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Abstract: Surface quality defects such as microcracks and folds are easy to occur at the bending point after bending of bend pipe. In this paper, by using a six-degree-of-freedom manipulator to drive the electromagnetic field generator to move back and forth along the processing path, and the electromagnetic field generator to drive the spherical auxiliary magnetic pole to rotate around the inner wall of the tube, the inner surface finishing of the bend pipe is realized. On this basis, the center line of the bend pipe is reconstructed and transformed into a new grinding path by collecting the outline of the bend pipe and fitting the curve. The morphology and roughness of bend pipe before and after grinding test were compared and analyzed by using super depth-of-field 3D electron microscope and stylus surface roughness measuring instrument. The results show that by reconstructing the grinding trajectory, the experimental device effectively solves the problems of interference and uneven grinding at the grinding bend. After grinding

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