



### 螺旋流抑制杆管偏磨的PIV实验研究

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### EXPERIMENTAL STUDY ON THE SPIRAL FLOW RESTRAINING ECCENTRIC WEAR OF THE SUCKER AND TUBING WITH PIV

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**摘要** 为了研究聚驱采出井偏心环空中流体流动状态与抽油杆所受法向力的关系,在模拟井筒中产生轴向流和螺旋流,利用粒子图像测速技术(PIV),测量了不同质量浓度聚合物溶液,在偏心环空窄间隙、宽间隙中轴向流和螺旋流的速度瞬时特性,并将它们的轴向速度梯度进行了比较。利用设计的实验装置测量了介质为不同质量浓度聚合物溶液时,轴向流和螺旋流的条件下,偏心环空中单位长度抽油杆所受的法向力。结果表明:偏心环空中螺旋流的轴向速度梯度比轴向流小,且窄间隙中螺旋流轴向速度梯度减小的幅度比宽间隙大;螺旋流条件下,单位长度抽油杆所受法向力小于轴向流。利用在井筒中产生螺旋流的方法可抑制聚驱采出井杆管偏磨现象。

**关键词:** 偏磨 螺旋流 轴向速度梯度 法向力 聚驱采出井 PIV

**Abstract:** To study the relationship between the state of fluid flow and the normal force applied to the sucker in the eccentric annulus of the polymer flooding oil recovery well, firstly the paper measures the axial flow and spiral flow produced in a simulated well, then studies the speed transient characteristics of the axial flow and the spiral flow in the eccentric annulus with narrow and wide gap under different mass concentrations of the polymer solution, and the axial velocity gradient of the axial flow and spiral flow is also compared with each other using the particle image velocimetry (PIV). The normal force of the eccentric rod of unit length is measured in different mass concentrations of the polymer solution media, also in the conditions of the axial flow and spiral flow using experimental device designed by our own. The results showed that, the axial velocity gradient is smaller than that of the axial flow in the eccentric annulus, and the decreasing magnitude of the axial velocity gradient in the narrow gap is larger than that in the wide gap; in the conditions of spiral flow, the normal force of the sucker of unit length is less than that in the axial flow. Using the method to generate the spiral flow can inhibit the sucker and tubing wear phenomenon in the polymer flooding oil recovery well.

**Key words:** eccentric wear spiral flow gradient of the axial velocity normal force polymer flooding oil recovery well PIV

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