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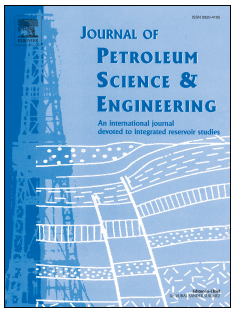


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# Working mechanism and rock-breaking characteristics of coring drill bit

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**Abstract:** For improving the rate of penetration of the complex well structure and performance of the coring drill bit, this paper is to investigate a new type of coring drill bit that generates small-diameter core samples during the drilling process. A special jet channel is designed inside the drill bit body, and the high-pressure drilling fluid flows through the special jet channel to the coring channel, then the cored rock is taken out of the downhole from the drill bit under the negative pressure. Based on the hydrodynamics theory, rock breaking mechanics and actual drilling conditions, the rock breaking mechanism model of the coring drill bit is established. The difference of rock breaking performance between the new drill bit and the existing drill bit is analyzed based on the analysis of numerical example, laboratory and field test. The research results indicate that the special structure design made the new drill bit has the effect of 'absorbing the bottom rock cuttings and pushing the upper rock cuttings' during the process of rock breaking. The effect can reduce the repeated cutting of cores at the bottom hole and improve the ROP(rate of penetration). Field tests show that when the flow rate of drill pump is 25L/s, the result of ROP can be increased to 15%~40%. The new design drill bit can present innovative ideas for improving the efficiency of coring and the quality of geological logging during the drilling process. Moreover, the analysis models can provide references for the new research of improving ROP and drilling efficiency, especially under the conditions of complex structure or large displacement wells.

**Keywords:** Drilling; Coring drill bit; Drillability; ROP(rate of penetration); Mechanism; Cores

# 1 Introduction

During the process of current oil and gas exploration and development, the formation core has an import significance to oil and gas production technological process. Compared with the previous core drilling, the formation core in the drilling process can not only accurately record the formation lithology parameters, assess petroleum resources and determine exploration value, but also including: (1) According to the stratum lithology parameters, the relevant geologic position of drilling tools can be optimized to improve the drilling speed, save production costs and reduce the risk of downhole accidents[1-5]; (2) The complete formation core can provide important basic data and reference for petroleum resources development and increasing production in the later stage[6-9].

At present, the cuttings produced by cutters of conventional PDC drill bit in drilling engineering are tiny and even complete distorted due to its special rock-breaking mechanism, and as a direct consequence, it is difficult to be sampled, analyzed and identified in geologic control and accessibility petroleum resources[10-13]. Therefore, different types of drill bits are often used to meet the requirements of drilling and coring in the actual drilling process. Nevertheless, the high drilling cost and long drilling cycle seriously affect the drilling efficiency. For solving the above problems, a variety of coring drill bits have applied to the drilling engineering, which generates cores during conventional drilling operations. This kind of coring drill bit is different from the conventional PDC drill bit, which forms an evacuation area instead of arranging the cutter at the central region of the drill bit. The evacuation area is a wider and deeper junk slot between the 2

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